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Unasylva

A Review of Forestry and Forest Products

May-June 1949 Vol. III, No. 3

GREEN GOLD. The cover picture is from the United Nations film *Green Gold.* It shows new methods of pollination being tried out. This tree proved to be a fine specimen, growing faster than most of its kind. To obtain high-grade seeds, scientists covered the flowers with paper bags so that no pollen from other trees could reach them. Then they injected pollen from the tree itself into each paper bag. A few months later the new seed was ready for sowing.

The film *Green Gold* was produced in 1948 by the Svensk Filmindustrie, Sweden, for the United Nations. It deals with world problems of timber, trade, and conservation of forests, and shows the role played by FAO in developing timber production around the world. Information about distribution is available through the United Nations Department of Public Information, Lake Success, New York, N. Y., U.S.A. Length 20 min. B and W, size 16 or 35 mm. Narration English, French, Swedish.

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Soils, Waters, and Forests

THE constructive management of soils, waters, and forests combines to form an interwoven trinity best called "conservation of renewable resources." As the three basic elements are treated constructively and in harmony one with the other, so, with agricultural and forest products, may systems of distribution, economics, and trade within and between nations derive stability and a chance for permanence. Unequal attention to any one can only, in the verdict of history, lead to ruination of the world's productive estate of land and water.

This indivisible grouping is set and perpetuated by natural law. Man's many attempts to ignore the law have been notable only for their uniformly disastrous outcome.

Merely to state the inviolable unity of soils, waters, and forests in a single system should, it would seem, carry the ready conviction that sustains any self-evident truth. And indeed comprehension of the role of conservation in the future of man and his world is spreading. But is it evident that man's efforts to live in and maintain his indispensable environment display a true, insistent, and practical recognition of this role? Scientists in and out of government have formed themselves into more and more specialized groups, each worthy in itself, each in its own more or less airtight compartment, each dealing with but a fraction of the unity of soil, water, and forest. So, too, with governmental organization; in its common pattern it has broken up into various agencies, each dealing with and claiming jurisdiction over a part of the whole.

It goes then without saying that the key role of each element can be neatly and conclusively established by those whose lives are occupied in dealing with soil, or water, or forest.

To the agriculturist, the very basis of life is the croplands, and in his preoccupation to make them produce, he may never lift his eyes unto the hills. To the manager of the great circulating medium, water, neither croplands nor protective forests have life and meaning, except as water is gathered, controlled, and distributed. The massive structures which are now technologically within his grasp, and which enable him to accomplish his ends, tend to become a fascinating end in themselves. To the forester, it is obvious that the health of the wild lands which regulate water flow hold together conservation as a unified enterprise, and that attention to forests should precede rather than follow development of water and land resources.

Each point of view is, of course, correct; conservation cannot succeed permanently without proper attention to every resource. But the heart of the problem is not to appraise the exact degree of essentiality of soil, water, or forest in general or in particular situations. It is rather to establish the habit of joint study and consultation — meeting grounds to which each member of the natural team may come with no compulsion to uphold the pre-eminence of his role as custodian of one of the elements forming the trinity. Only as this can be brought about can a three-stranded cord be woven, stronger than the sum of the separate strands.

How to ensure such free-minded study and planning by organized means is a problem, which nations and professional men have by no means solved, but various experiments are even now being worked out toward this end.

Foresters, no less than their professional brethren who deal with soil and water, will need to broaden their approach to the conservation problems of which they are inescapably a part. Just such an approach is evidenced in the participation of FAO's Division of Forestry and Forest Products in the Seventh Pacific Science Congress. The results of this Congress augur well for a continuing and deepening co-ordination in the approach of all whose varied interests and activities mesh in the conservation of renewable resources. We hope this co-ordination will be further strengthened by the United Nations Scientific Conference on the Conservation and Utilization of Resources to be held at Lake Success, New York, from 17 August to 6 September 1949.

Spreading the seed. The plane flew at about 80 miles per hour, 50 to 75 feet above tree-top level.

Airplane Seeding

A New Venture in Reforestation

By MARINUS WESTVELD

This paper was presented at the national meeting of the Society of American Foresters, Boston, Massachusetts, 16-18 December 1948. A number of members of the Northeastern Forest Experiment Station of the U. S. Forest Service assisted in this project. Among them were: A. C. Hart, V. S. Jensen, W. J. Kidd, Jr., T. W. McConkey, J. R. McGuire, T. F. McLintock, W. E. McQuilkin, S. F. Ricker, F. M. Rushmore, E. J. Schreiner, R. F. Taylor, and M. J. Williamson. The writer gratefully acknowledges their assistance.

DEVASTATING forest fires such as those that swept through Maine in October 1947 present difficult and challenging problems in rehabilitation. How can such areas be brought back promptly into tree production? Forest fires frequently burn with such intensity that they destroy not only all reproduction but the timber as well. This is the condition in which thousands of acres of white pine forest were left following the Maine conflagration last fall. If the Massabesic Experimental Forest (which lies in the center of the York County burn) is a fair sample, about 40 percent of the burned forest area is in such a condition. If such areas are to be rehabilitated in the near future, artificial reforestation will be necessary.

This can be accomplished in two ways: (1) by planting nursery grown stock, and (2) by direct seeding. On the Massabesic Experimental Forest direct seeding by airplane was chosen for several reasons. The area in need of reforestation was extensive and afforded an opportunity to test direct seeding on a reasonably large scale. The method possessed possibilities for rapid ground cover and for speedy reforestation at greatly reduced costs. Ground conditions were favorable for germination of seed because most of the underbrush and other competing vegetation had been detroyed by the fire. The danger of serious seed losses from rodents had been minimized by the hot fires which had reduced rodent population to a considerable degree. And lastly, the method provided the opportunity for developing much needed informa-

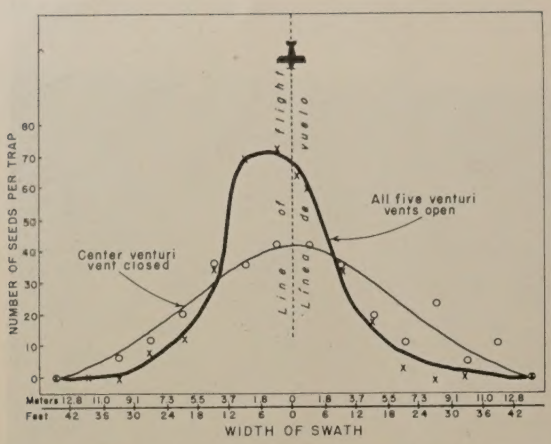


Fig. 1. Pattern of seed distribution by airplane seeding, based on the equivalent of 21 trial flights.

tion on the potentialities of airplane seeding as a means of successfully regenerating recently burned forest land. The venture would also yield valuable by-products such as the cost of airplane seeding compared with other direct seeding methods and planting operations, as well as procedures to be followed to obtain the best results from this method of reforestation.

Previous Airplane Seeding Operations

The Massabesic aircraft seeding project was not the first of its kind attempted in the United States. In 1946 the State of Oregon seeded a 500-acre burn (200 ha.) to Douglas fir, *Pseudotsuga taxifolia,* and Port Orford cedar, *Chamaecyparis lawsoniana,* in equal proportions at the rate of ½ pound per acre (0.6 kg. per hectare) and 100 acres (40 ha.) of grass and brushland to western hemlock, *Tsuga heterophylla,* Sitka spruce, *Picea sitchensis,* and Port Orford cedar at rates of ⅛ and ¼ pound per acre (0.14 and 0.28 kg. per hectare). The State Forester reports that 21.7 percent stocking resulted.

The Crown-Zellerbach Corporation in 1947 undertook airplane seeding of 1,100 acres (450 ha.) in Oregon. The success of this seeding remains to be determined. The company schedule called for the seeding of 2,600 additional acres (1,100 ha.) by helicopter in 1948.

Airplane seeding of burns has also been undertaken in Canada. The Ontario Department of Lands and Forests has sown spruce, *Picea sp.,* as well as red pine, *Pinus resinosa,* and white pine, *Pinus strobus,* by aircraft. Sowing densities ranged from 5 to 10 thousand seeds per acre (12 to 24 thousand seeds per hectare). The Department has pronounced these seedings moderately successful.

The New Brunswick Department of Lands and Forests has also been active in this field. In 1947 it undertook to reseed burned-over Crown lands from the air. Germination as high as 6,000 seedlings per acre (15,000 per hectare) was obtained on 1947 burns. Results on 1944 burns, however, have been disappointing. This poor showing is attributed to excessive competition from the vegetation with which the older burns are clothed.

Developing Techniques

A survey of the Massabesic Experimental Forest after the forest fires indicated the need of artificial reforestation on some 2,200 acres (890 ha.). The original plan of the Northeastern Station was to sow both red and white pine seed. However, no red pine seed could be obtained, and white pine seed proved to be both scarce and costly—only 800 pounds available at a cost of $6 per pound (360 kg. at $13 per kg.). Thus, relatively light sowing densities were essential to assure seeding of the 2,200 acres.

Densities of 4,000 and 8,000 seeds per acre (10,000 and 20,000 seeds per hectare) were decided upon for most of the area. For small test tracts, plans called for densities of 20,000, 40,000, and 56,000 seeds per acre (50,000, 100,000, and 140,000 seeds per hectare).

Before the seeding could be undertaken, it was necessary to conduct test flights to determine the best methods for attaining these dispersal rates. The problem was to dilute the seed with some other substance. Tests were made early in February 1948 at the U. S. Department of Agriculture's Beltsville Research Center airfield, in co-operation with the Bureau of Entomology and Plant Quarantine. The airplane used was a Navy trainer biplane. The same plane was used later in the Massabesic seeding operations.

This plane carried the seed mixture in a 17-bushel* hopper installed in front of the pilot's cockpit. The seed mixture was fed by gravity to the bottom of the hopper where agitators (powered by wind-driven propellers mounted on the plane wing) kicked it through the slot gate (regulated by a lever in the cockpit) into a simple fishtail spreader attached to the under side of the fuselage. From the spreader, the slip stream blew the seed mixture out through Venturi vents designed to spread the mixture.

Two diluents, wheat and sawdust, were tested. In the first tests wheat was used. It was soon evident that a very high ratio of diluent to seed would be required for sowing densities as low as 4,000 and 8,000 seeds per acre. With wheat priced at an all-time high, there was strong inducement to experiment

*1 U. S. bushel = 35.24 liters.

Mixing white pine seed with sawdust. Sawdust was found to be the best diluent for assuring the desired seed dispersal.

with a cheaper diluent. After a number of runs with wheat, sawdust was used as a substitute. Using varying proportions of diluent, test flights were run at different elevations under varying hopper apertures, wind velocities, and wind directions.

To get a measure of these factors on width of swath and density and uniformity of seed distribution, seed counts were made on a series of seed traps. Two types of seed traps were used. The first type, a paperboard box 3 feet by 3 feet with 12-inch sides (90 cm. x 90 cm. x 30 cm.), proved unsatisfactory. It was observed that occasional seeds bounded out of these containers. A more secure trap was finally devised. It consisted of a 3-foot-square flat surface of thin wallboard over which strips of cotton batting were glued. Seeds striking the surface of this batting were held firmly in place.

A total of 48 seed traps in three parallel rows spaced 100 feet (30 m.) apart comprised the series. Each row contained 16 seed traps spaced 3 feet (90 cm.) apart, so that the length of each row was 93 feet (28 m.). This pattern permitted evaluating the density of seed distribution both parallel and at right angles to the line of the plane's flight.

The early test runs were made with all Venturi vents open. The resulting seed distribution pattern is indicated in Figure 1. It shows a high concentration of seed along a relatively narrow band straddling the near center of the swath. To reduce the heavy seed density deposition along the center and to attain a more uniform spread over a wider swath, a number of flights were made with the center Venturi vent covered with a tin cap. The greatly improved distribution which resulted is indicated by Figure 1.

Approximately 80 flights provided an adequate basis for determining effective swath width and the ratio of diluent required to attain a specified seed dispersal rate. By trial and error, proportions of 12 sawdust to 1 seed, 6 to 1 and 3 to 1 by volume were found to give density rates of approximately 4,000, 8,000, and 16,000 seeds per acre (10,000, 20,000, and 40,000 seeds per hectare) with the hopper aperture set at ¼ inch (6 mm.). Effective swath width was calculated to be approximately 50 feet (15 m.). From Fig. 1 it can be seen that the actual spread of the seed was greater than this by some 25 feet (7.6 m.). This overlap assured a fairly uniform density sowing.

Seeding the Massabesic Burn

The seeding operation on the Massabesic burn was begun late in February 1948. The conditions at the time were considered ideal. The ground was covered with 2 feet (60 cm.) of snow. The snow surface was frozen and dotted with countless small pits that acted as small traps to catch and hold the seed.

In preparation for the seeding flights, a ground crew marked the boundary lines and corners of the area and erected windsocks.* Since the Massabesic Forest consists of two areas, a north unit and a south unit, both extremely irregular in shape, 64 markers were needed to define the boundaries of the areas to be seeded. The ground crew spent a total of 156 man-hours in erecting and dismantling the windsocks.

The white pine seed was mixed with the sawdust in a small motor-driven cement mixer. Fresh white pine

Pouring the seed mixture into the hopper of the airplane. The pilot is an expert in aircraft spraying.

sawdust, which had previously been screened through a ¼-inch (6 mm.) mesh, was stockpiled under cover. A crew of from two to three men was used to operate the mixer and sack the material. Two men can handle the job with little difficulty. The usual charge was one bushel of sawdust plus the required amount of white pine seed. The machine was run until the charge was thoroughly mixed, then the seed mixture was poured into a basket and sacked in 2-bushel lots.

Mixing output ran about 16 bushels of mixture per hour. It was noted that the bottom of the charge tended to be poorly mixed. This was overcome by loading half the quantity of sawdust then half the required amount of seed followed by the remainder of sawdust and seed. The mixer had to be operated at least 3 minutes to assure a good mix. Different lots of sawdust may require longer mixing time. This can be determined by inspecting the charge and increasing the time if necessary.

A light truck was used to transport the bagged seed mixture to the airplane base 7 miles (11 km.) away.

On the seeding flights, the airplane flew at about 80 miles (130 km.) per hour, 50 to 75 feet (15 to 23 m.) above tree-top level. The interval between flight lines was about 50 feet (15 m.). The pilot was provided with a map of the forest showing the areas to be seeded, the acreage in each, and the density of sowing desired. Prior to the actual seeding, the pilot made "dry runs" over each of the two units of the forest to gain familiarity with the areas to be sown. In addition to the windsock markers, he used roads and fields as flight guides.

To assure uniform seed distribution the two units were subdivided into flight blocks. These ranged in size from 140 to 265 acres (57 to 107 ha.). The quantity of sawdust-seed mix required to cover each block was calculated in advance. The hopper of the plane was filled with an amount of mix sufficient to cover the block at the desired sowing density. Thus each block was assured its calculated quota of seed. In several instances the pilot flew the same block more than once, broadcasting the seed several times in different directions.

Approximately 1,000 acres were sown at a density of 4,000 seeds per acre. Another 1,100-odd acres were

*The crew members were John W. Regan and Walter R. May, on loan from the Bureau of Entomology and Plant Quarantine, and one assistant. The first two men were experienced in organizing and setting up ground installations for aircraft spraying.

sown at a density of 8,000 seeds per acre. To provide a wider range of sowing densities, three small tracts aggregating approximately 120 acres were sown to densities of 20,000, 40,000, and 56,000 seeds per acre. Distribution of sowing densities is shown in Table 1.

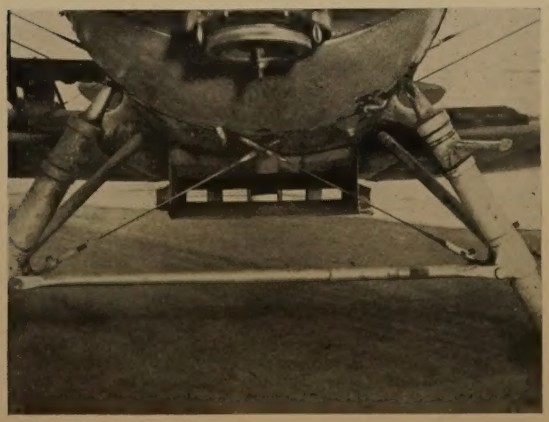
Such ground checks as could be made showed very satisfactory distribution. Since 11 flight blocks were established, 11 separate flights were required to seed the 2,200 acres of severely burned area to sowing densities of 4,000 and 8,000 seeds per acre. A total of 154 bushels of seed mix was used in the process. The air base from which the plane operated was approximately 6 miles (10 km.) from the seeding operations. Total elapsed time per flight, including loading of plane, map checking, lunching, and other incidentals, averaged one hour.

TABLE 1.—QUANTITIES OF WHITE PINE SEED MIX SOWN BY AIRPLANE ON BURNED AREAS OF THE MASSABESIC EXPERIMENTAL FOREST TO GET SEED DISTRIBUTION OF VARIOUS DENSITIES

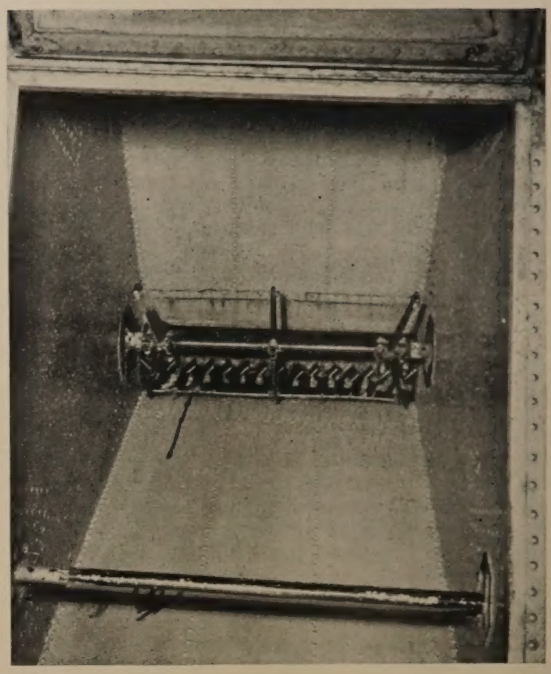
Location	4,000 seeds per acre[1]		8,000 seeds per acre[1]	
	Area sown[2]	Seed mix sown	Area sown[2]	Seed mix sown
	acres	*bushels*	*acres*	*bushels*
North unit	220	15.4	235	16.5
North unit	140	9.8	170	11.9
South unit	265	18.5	160	11.2
South unit	202	14.1	229	16.0
South unit	203	14.1	220	15.4
South unit	——	——	160	11.2
Total	1,030	71.9	1,174	82.2

1 acre = .4047 hectare.
1 bushel = 35.24 liters.
4,000 seeds per acre = 10,000 seeds per hectare.
8,000 seeds per acre = 20,000 seeds per hectare.
[1]Sowing densities of 20,000, 40,000, and 56,000 seeds per acre (50,000, 100,000, and 140,000 seeds per hectare) were undertaken on blocks of 57, 28, and 32 acres (23, 11, and 13 hectares) respectively using mixtures of 3 volumes of sawdust to 1 volume of white pine seed.
[2]Three check areas of 24, 34, and 38 acres (10, 14, and 15 hectares), the first two in the south unit and the last in the north unit, were established on which no airplane seeding was undertaken.

Almost as soon as the sowing was completed, snow began to fall, and covered the area to a depth of 5 to 8 inches (13 to 20 cm.). This undoubtedly helped to reduce depredations by birds and rodents to a minimum.



The fishtail spreader on the underside of the airplane. Notice the five vents, the center one closed.



Close view of the hopper, from above, showing the slot gate and agitators.

In addition, under a co-operative arrangement with the St. Regis Paper Company, the Station seeded by airplane 400 acres (160 ha.) on company holdings, near Whitneyville, Maine, which had also burned in 1947. Seeding was at a rate of 5,000 seeds per acre (12,000 seeds per hectare). Ground installations on the St. Regis operation were simple. The tract was a rectangle, and required only six windsocks.

COSTS

Cost records maintained for the airplane sowing operations indicate an approximate cost of $3 per acre ($7.25 per hectare) for a sowing density of 8,000 seeds per acre (20,000 seeds per hectare). This cost was made up as follows:

	Cost per acre	*Cost per hectare*
Seed	$2.40	$5.90
Ground installations	.20	.50
Flying costs	.30	.75
Seed-mixing costs	.04	.10
Total	$2.94	$7.25

The flying cost item of 30 cents per acre (75 cents per hectare) does not include rental or depreciation charges for the airplane. However, a highly reputable airplane service corporation offered to undertake the seeding of the area for 50 cents per acre ($1.10 per hectare).

The major cost item was seed. The sowings of 4,000 and 8,000 seeds per acre called for ⅕ and ⅖ pound of seed per acre (⅕ and ⅖ kg. per hectare for sowings of 10,000 and 20,000 seeds per hectare). With white pine seed selling for $6 per pound ($13

per kilogram), the cost of seed alone amounted to $1.20 and $2.40 per acre ($2.95 and $5.90 per hectare). The total cost of the Oregon airplane seeding project—including rodent control and snag felling was $5.13 per acre ($12.70 per hectare). With the present high cost of planting stock and prevailing high wages it is doubtful that planting operations can be conducted for much less than $35 per acre ($86 per hectare), more than ten times the aerial seeding costs. Cost of sowing seed by hand varies considerably, depending upon sowing densities and techniques used. Experience indicates that for comparable sowing densities, hand-sowing costs are approximately double those calculated for airplane sowing. Thus airplane sowing costs are substantially lower than other orthodox methods of artificial reforestation. In the final analysis, however, airplane seeding costs mean little until more evidence is available on the degree of success to be expected.

Results

It is still too early to judge the success of the airplane seeding venture. However, seedling counts made last summer and fall show reasonably satisfactory results. Counts made on the Massabesic burn late in August showed from 25 to as high as 2,475 seedlings per acre (60 to 6,120 seedlings per hectare). Success varied with the character of the seedbed as influenced by degree of burn. For example, Table 2 shows that germination on the severely burned areas ranged between only 2.5 and 11.9 percent in contrast to more than 25 percent on the moderately burned areas. Although further research is needed to account fully for these striking differences it is believed that high soil surface temperatures and deficient moisture were major factors. Few seedlings were found in heavy charcoal soils.

From Table 2 it will be seen that most satisfactory results were obtained on the moderately burned areas, with 725 stocked quadrats per acre out of a possible 1,000 and an average of 2,475 seedlings per acre for the 8,000 sowing density. For the 4,000 sowing density the corresponding figures are 525 and 1,325. On the heavily burned areas the 8,000 and 4,000 sowing densities yielded only 150 and 25 stocked quadrats per acre with 175 and 25 seedlings per acre respectively.

Table 2.—Summary of Seed Germination and Seed Counts in the Massabesic Experimental Forest Airplane Seeding Experiment at the End of the First Season

Method and density of sowing	Germination	Seedlings	Stocked quadrats
	percent	*number*	*number*
Moderately burned areas			
Airplane:			
4,000 seeds per acre	28.4	1,325	525
8,000 seeds per acre	28.4	2,475	725
Natural	.....	298	134
Severely burned areas			
Airplane:			
4,000 seeds per acre	2.5	25	25
8,000 seeds per acre	11.9	175	150
Natural	.....	0	0
By hand:			
4,000 seeds per acre	8.2	250	200
8,000 seeds per acre	8.2	400	175

1 acre = .4047 hectare.
1,000 seedlings per acre = 2,500 seedlings per hectare.

Part of the good stocking on the moderately burned areas must be attributed to germination of natural-borne seed that survived the fire. On the basis of counts made on check areas, naturally shed seed accounts for approximately 300 seedlings per acre. It is interesting to note that on severely burned check areas where no aerial seeding was done not a single white pine seedling was found. In general, newly germinated seedlings on the burned areas are large, vigorous, and thrifty. Some mortality is expected in the course of the winter, but these losses may be compensated by delayed germination next spring. Counts on the St. Regis tract show an over-all average of approximately 175 seedlings per acre.

In conclusion it may be stated that aerial seeding of burned-over timber lands, if undertaken under proper conditions, is economically feasible. Rapidity of seed distribution and favorable cost factor are its chief attractions. There is much still to be done in improving methods and techniques. It is clear, however, that airplane seeding did partially stock the burned areas with white pine.

All photos courtesy U. S. Forest Service

Huts and Houses in the Tropics

By JACOB L. CRANE

Decent housing is a basic human need. Bad housing brings discomfort; but it also results in a high incidence of disease which reduces human working capacity and thereby decreases food production and lowers the level of nutrition. A disastrous cycle is thus created.

Improved housing can help to break the cycle and bring about better health, better agricultural production, better nutrition, and perhaps better conservation of the land. Indirectly, the improvement of housing, particularly rural housing, is a link in the far-reaching chain of FAO's interests and activities.

Moreover, some of the methods by which housing may be improved fall directly within the range of FAO's concern. Notable, for example, are the greater and more skilful use of forest products as primary construction materials, and the development of methods of education and social organization through which the housing problem, particularly the rural housing problem, may be met.

In this article the author suggests a practical approach specifically adapted to the problem in the light of existing social organization, financial capacity of people and governments, and construction material available in tropical regions.

IN THE tropical and semitropical regions of the world about 1,000 million people make their homes. These men, women, and children make up something in the order of 200 million families. A very small proportion of these families live in good houses. All the others live in huts of one type or another.

The literature of the temperate zones is full of romancing about the thatched hut of the tropics. Although the war in Asia, the Middle East, and Africa dispelled part of the illusion for Europeans and Americans, the legend of languorous living in palm-shaded shelters persists in Northern minds. But judged by more humane, if more prosaic, standards, the tropical hut is not a good dwelling place.

To be sure, it has good points. It has evolved in various forms out of thousands of years of tradition and trial and error. The earthen wall, in many variations, is relatively cool. The thatched roof constitutes in effect a porous awning which cuts off the sun and rain but permits the air to move through. Most important, the tropical hut can be and is built mainly by the family itself, with local materials which cost nothing but the work of gathering them. These are great virtues; and they suggest principles for any sensible program of improvement in the housing of tropical people.

A closer look reveals some reasons why those who can afford houses do not live in huts such as are found in the tropics. Most tropical huts and settlements lack even elementary sanitation. Often the huts are crowded together. The earth floor is dirty at best. The walls and roofs are verminous. Smoke fills the space-inside. And that space is too small—much too small for health or comfort. The homes of most tropical families are substandard by any reasonable appraisal.

Skeptics will say that these families are content to live the way they do and that they should continue to live that way. This is not true. Once convinced that better homes are available without damage to them in other respects, nearly all families who live in huts (or slums) anywhere will jump at the chance.

There were families in semitropical South China who felt that their self-built huts were better for family living than the very narrow new municipal houses. In Ceylon, people did not want to move from their own little shelters into the "company" housing because they feared eviction in bad times. Some families in South America preferred their squatters' huts to the new houses which involved an obligation to pay rent in cash. One old couple who did not want to move said the important things were their tea, their mutton, and good conversation; they could bathe outdoors when it rained.

But all of this is not relevant to the real problem. As part of the wide popular demand for better living conditions, a great movement to improve tropical housing is beginning to take shape.

Accordingly, many governments and many individuals and organizations all over the tropical world are trying to discover formulae by which the mass of their people can lift themselves from this stage of primitive, unhealthy living.

The proposition outlined here derives from many years of intermittent observation and work in the field of tropical housing. It is addressed particularly to the governments and the popular leaders who are concerned about tropical housing.

Since economic relationships vary widely in different tropical regions, the examples are simplified by the use of figures which illustrate the case, rather than by the presentation of comprehensive statistics. For convenience, computations are outlined in terms of dollars, rather than in rupees, pesos, gourds, or any one of fifty other monetary units.

The Cost of Building Houses

When officials undertake to estimate the cost of building decent housing—the cost, say, of substituting even minimum sanitary houses for insanitary tropical huts—they are likely to base their estimates on the use of commercial materials and the employment of "contractors" for construction. In other words, they may assume, and many do, that the labor and skill will not be provided by the people who will live in the houses. This is the modern method of construction, widely used in all highly organized societies.

A design is prepared. A site is selected. An arrangement is made with a construction organization. That organization, the contractor, secures the materials and equipment and brings in the construction workers. Then, after construction, the family moves in, and undertakes to pay for having its house built by others.

There are many variations and modifications of this process. But it constitutes one end of the spectrum, and, for most tropical housing, it costs too much. Let us take a look at this cost from several points of view.

First, the family point of view: The cash incomes of families in tropical areas may be represented by the figure of $100 per year, with no visible means of soon increasing this income. Many tropical families earn the local equivalent of more than this; many earn less. There is no reliable average or median figure; but $100 may be taken as typical of at least some tropical situations.

In such a region, a new tropical house for a family of five, designed to meet even the most minimum responsible standards, and built by contract, will cost at least $1,000 nowadays. But the families rarely possess the local equivalent of this amount to pay out in cash for a house. Further, under present circumstances, the prospect of accumulating that much for the purpose is usually very slim, even over a long period of years. Even if the family were permitted to pay off the thousand dollars over say, 20 years, at low rates of interest, the payments would still demand too large a portion of the family income. In most tropical societies as now organized, the debt would be a millstone around the family's neck.

Second, from the point of view of the government: Let us take the hypothetical case of a small, sovereign tropical nation, which is trying to formulate a practicable housing program for its people. Three-fourths of the population, perhaps 600,000 families, now live in totally insanitary huts. New sanitary houses of absolutely minimum standard, if built by contractors, would cost at least $1,000 each. A construction program for such houses, spread over 20 years, and allowing for an increase in population meanwhile, would involve a cash outlay of something like $40,000,000 a year. Out of its actual revenues (assuming maximum taxation) the government may be able to devote only $300,000 per year for popular housing over a sustained period. The government cannot carry anything like a $40,000,000 program each year, by any possible financial formula. The resources of the country at present cannot handle national housing improvement by the method of having new houses built entirely by others than the families themselves.

Third, the world problem is even more overwhelming. To provide new minimum tropical houses at the rate of 10,000,000 per year (in the hope of catching up with the need in 25 or 30 years) would cost at

Aided-self-help of prefabricated wood construction.

Aided-self-help houses of stone and timber.

least $10,000,000,000 per year, if the contractor method were used. Now, the world community could probably afford such an outlay, if the relatively rich subsidized the relatively poor, as is done for low-income housing to some degree within most of the more advanced countries. But this does not seem an early prospect, even though it may be considered an eventual international objective.

Some will point out at this juncture that economic progress, industrialization, and greater productivity will make it possible ultimately for families and nations to provide for every tropical family at least the thousand-dollar house built by the contractor method. This is a basic goal to be achieved as rapidly as all circumstances permit. But meanwhile the families, the popular leaders, the governments, and the international organizations face the question of what to do now, during the intervening relatively long period. For, at this time, no way has been found to provide such minimum houses in large numbers for the millions who live in huts.

This is not a criticism of construction of houses by contractors of one type or another. Where families or communities can afford this method, it is probably the best that has been devised. In fact, in nearly all situations the use of the contractor to some degree is most economic. This is a black-and-white case to bring out the principles and the proposition which are herewith submitted.

Wealth of Manpower and Materials

Against the discouraging picture outlined, let us make a sort of appraisal of the resources which are readily available now and which may be mobilized for dealing with the problem of popular housing in the tropics.

The greatest resource is the manpower of the families themselves. Most tropical families have always built their own huts. In doing so they have developed certain knowledge, certain traditions, and certain skills. Unaided, and bound to some degree by tradition, they cannot build better than the poor huts in which they live. But, with some training and some financial and technical assistance, this resource in manpower is potentially enormous.

If two members of each family in the small tropical country cited above devoted one day per week to home improvement work for a year, and if a monetary value of only a half-dollar per man-day were placed on this work, 600,000 families would provide an annual value in self-help of $30,000,000. If, during any one year, only one family in ten took part in a program on this basis, the value would total $3,000,000. Contrast this with the meager $300,000 which represents the amount which it is feasible for the government to lay out in cash each year for popular housing.

The greatest single immediate resource for dealing with the wide improvement of existing shelter in the tropics, therefore, is self-help.

The self-help principle is not limited to use in tropical regions. It is the prevailing principle for rural housing in most of the world; and it is a great factor for urban housing in Sweden and other countries. But it is probably best adapted to use in the tropics.

The monetary value of self-help is great, but this is not its greatest value. When the family and its neighbors play a major role in making better homes, their satisfaction and pride in creation and accomplishment can be one of the most important things in their lives. Real homes must be built with love; and only the family which helps to make its own home can build with love. Further, the self-help principle makes it much easier for the family to be the permanent "owner" of the house. This has great merit in fostering a sense of security, since it reduces the fear and danger of eviction. In addition, occupant ownership permits self-help in maintenance and further improvement, without the need for any relatively large cash expenditures.

In evaluating resources for tropical housing, consideration must be given to the abundant materials for building that lie close at hand in nearly every locality. Most families in the tropics rarely purchase basic materials. They cannot afford to do so, and they do not have to do so. In traditional self-help building, earth is taken for walls, saplings and branches for wattle, thatch for roofs, and so on, in wide variation.

The presence of local native materials constitutes an enormous resource for building and for improving homes. But its potentialities are by no means realized as yet. Some industrial and semi-industrial methods are now being applied to the vast timber resources of the tropics; and they are making durable woods much more available for framing, for walls, for partitions, and for other shelter purposes. Industrial

processes can produce materials which are far better and which cost less in man-hours devoted to extraction and preparation. Simple machines can make good bricks instead of crumbling earth blocks; roofing can be made from the materials now used for verminous thatch; cement can be produced from ordinary limestone; pipes to be used in lieu of ditches can be made from asbestos or clay.

Of course, even the minimum improvement of homes in the tropics may require some equipment which it is not feasible to produce locally—metal articles for sanitation, perhaps hardware for doors and shutters, and electric wiring and fixtures, to name a few possible examples.

The basic resources in materials, however, are almost always available in the neighborhood.

Aided-Self-Help Formula

No single formula is applicable to all tropical situations, but with infinite modification and variation certain principles can be widely adapted to tropical housing problems. These principles are useful for countries or regions where the community decides to improve the present shelter of the whole population as best possible within the limits of its available resources, not where it decides to wait for a generation or two until it has achieved relatively great over-all economic advance, or where it decides to mobilize its resources to build a few hundred or a few thousand excellent houses.

On these two points great mistakes have been made over and over again. Virtually paralyzed by the enormous size and complexity of the task, many governments have in effect called it hopeless for the time being, and have decided to do almost nothing about popular housing. They do not like to take this negative and defeatist position, but they feel helpless when they are unable to find a practicable formula.

Or, conversely, under the necessity of making a start, they devote the resources which the government itself can muster to the construction of new houses for only one percent of the families who need them, or perhaps one-tenth of one percent. For example, if the government of the small tropical country used earlier for illustration were to devote its $300,000 per year to providing 300 one-thousand dollar houses, these would be far better than the huts but they would make almost no impression on the problem. Some 600,000 insanitary huts now exist and new families and new insanitary huts are being created at the rate of perhaps 10,000 per year. A program of 300 houses each year would eliminate the 600,000 huts in 2,000 years; and meanwhile,—well, it becomes preposterous.

So the Aided-Self-Help Formula is proposed for purposes of doing the best possible through the coming 10, or 20, or 30 years toward the transition from huts to houses for the 200 million tropical families who now live in conditions which are deplored by all who know them at first hand. And those conditions are extremely tough: mud, filth, vermin, serious overcrowding, darkness.

Elements of an Aided-Self-Help Program

Aided-self-help on the scale proposed cannot at once accomplish everything that may be desirable. It can only make shelter better in the most crucial respects.

These questions must be considered when applying the principle of aided-self-help: What elements of shelter in the tropics are most important? What phases should be given priority in utilizing the limited resources?

Clearly, priority should be given to solving the problems of land and of sanitation. For tropical

Huts and shacks more or less typical of many of the 200,000,000 occupied by families in tropical and semi-tropical areas.

living, the nature of the shelter itself is perhaps not most critical. The matter of land comes first. To achieve any marked improvement in the living environment there must be enough land, with secure tenure, in a reasonable location. At present this is not very often the case.

Health, cleanliness, and convenience require above all else potable water safe for drinking and cooking, and convenient for washing. Ordinarily, self-help alone cannot meet this need. A sanitary method for disposal of wastes is also necessary, but this can be provided by modern sewerage or by sanitary privies of some type.

For the shelter itself, the most needed improvements are hard, clean floors; better types of roofing; and larger, better divided inside space.

The elements which have to be aided now emerge. The community, through the government or otherwise, can assist the families with the problems of land, sanitation, materials, machines, organization, techniques and training. In this way the formula becomes self-help-plus, or aided-self-help.

This may be illustrated by a specific example. It is the same hypothetical example, but it comes close to the essential facts in some fairly typical situations. Assume 600,000 families living in primitive huts. Assume an increase of 10,000 each year in the number of poor families and poor huts. Assume a program aimed at the improvement of 20,000 homes each year. Assume cash incomes in the range of $100 per family per year; and assume that these families can and will pay out $1.00 cash per month for improving their homes.

Such a program might be organized to include:

Land and Utilities. In this example, the government will provide the land for the houses, install such utilities as can be afforded, and furnish the community services. For this application of the formula it is proposed that a monthly rental of a half-dollar be paid by the family to reimburse the government for its costs in the land-and-utility phase of the operation.

The land element involves selection of sites, and hence involves problems of town and country planning, and also site planning. These are very complex problems and they require the greatest skill and ingenuity, particularly in view of the tiny cash amounts available per family to cover the costs of land, utilities, and services. For greatest economy in site development and ideal application of the self-help principle in construction, the houses should be clustered and not widely scattered or piled up in flats. This means villages in the country and fringe settlements for the towns and cities.

The utilities include such water supply, sanitary drainage, and electricity as it is possible to provide for about fifty cents per month. Here is a field for technical research of the utmost importance, both by national and by international agencies. The utility arrangements now so common in the temperate zones must be entirely recast for minimum conditions in the tropics.

Community services include the best that can be devised at very small cost in the way of recreation facilities, fire protection, waste removal, road maintenance (if any), and such institutions as nurseries and clinics. Some part or all of the cash cost of such services is usually covered from funds other than the home improvement funds. Neighborhood co-operation can and must reduce the strictly local cash cost to very low figures.

Materials. Great progress is being made all over the world in the development of new types of materials and in the industrial processes for producing materials. Research in this field also offers great opportunities for international co-operation. In the example which we are reviewing here, the national government will make an exhaustive study of the materials problem. It will then proceed, as seems most sensible from year to year, to encourage the use of materials which the families can gather themselves; to encourage or directly develop the materials industries; and, where economic, to continue or facilitate the import of certain materials and equipment. The government may also initiate a plan for the storing and distribution of materials. Development of the materials industry may be part of a generally beneficial program of industrialization; and it may involve international credit and technical assistance.

At the end of two years this particular government may be encouraging the use of local earth plus cement for the floors and walls of existing huts; and for this purpose it may have established a new, small-scale domestic cement industry. It may have achieved the semi-industrial production of roof-framing timbers and also devised a home method of making doors and shutters from native woods. It may have introduced a design and a vermin-proof fiberboard roofing which offers complete insulation and ventilation. The fiberboard will probably be relatively short-lived but very inexpensive. From the experience of some other country, it may have found a method for drilling wells and for pumping, storing, and distributing domestic water supply which costs only a fraction as much as traditional temperate-zone methods.

The government has made compromises, and it still faces many problems; but, for the time being it has rationalized the materials supply for self-help housing; and it has made possible far better minimum houses than were possible before.

Construction. The families do most of the construction and improvement work themselves. The neighbors help; and skilled labor is drawn on only when necessary. The government provides simple plans and technical assistance. Equally important is the inauguration by the government of a training program on construction methods and on maintenance. If the other phases of the undertaking are operating well, the actual construction is easy.

For the types of small houses advocated at this time, it is necessary for the family to spend $70 on materials and equipment—cement, fiberboard, a little pipe, elementary electric wiring, and a chemical toilet box. The family also has to hire for two weeks, from the government or elsewhere, a manual machine for making earth-cement blocks, at a cost of $10. And $20 must be spent on skilled labor. In order to pay for these items during the relatively short period of construction, the government arranges for the family to borrow $100 and, over 20 years, to repay it with the other fifty cents per month which the family can

afford to lay out in cash toward the improvement of its home.

The Choice for Governments

It is clear now that the formula consists of Self-Help Plus: and that the plus is in the form of governmental assistance within the available resources and ingenuity. It is clear that, where this formula can be applied, it can improve very large numbers of houses which are far superior to the traditional huts. The government has a choice to make: it can do nothing now; build a very few excellent houses which will actually accomplish almost nothing as measured against the problem; or undertake an aided-self-help program.

True, the families have to become interested. A propaganda campaign and the offer of the formula will prove whether it will be taken up and become popular, or whether it can be reshaped for the purposes. Perhaps only a hundred families join up the first year. If it goes well, either as originally organized or as readapted, a thousand will subscribe the second year, and ten thousand the third year.

Even for so elementary a program, there is much for the government to do. A ministry or department or agency has to be designated or established. Competent people have to be assigned or engaged. The problems have to be catalogued, evaluated, and analyzed. A program has to be formulated. The fundamental matter of land and utilities has to be dealt with. Research has to be undertaken. International assistance and experience have to be canvassed. The supply of materials has to be rationalized. The small loans have to be arranged and effected. Education and training have to be instituted.

Formidable! Particularly for small governments with little experience in this kind of thing, or for governments with many millions of families who need little houses in place of poor huts. But what are governments for unless to tackle the great problems which their people cannot cope with unaided? Why develop agriculture and industry and trade, education and public health and welfare, unless concurrently the homes of the people, the culmination of national and family life, are advanced as rapidly as the available resources and skill make possible?

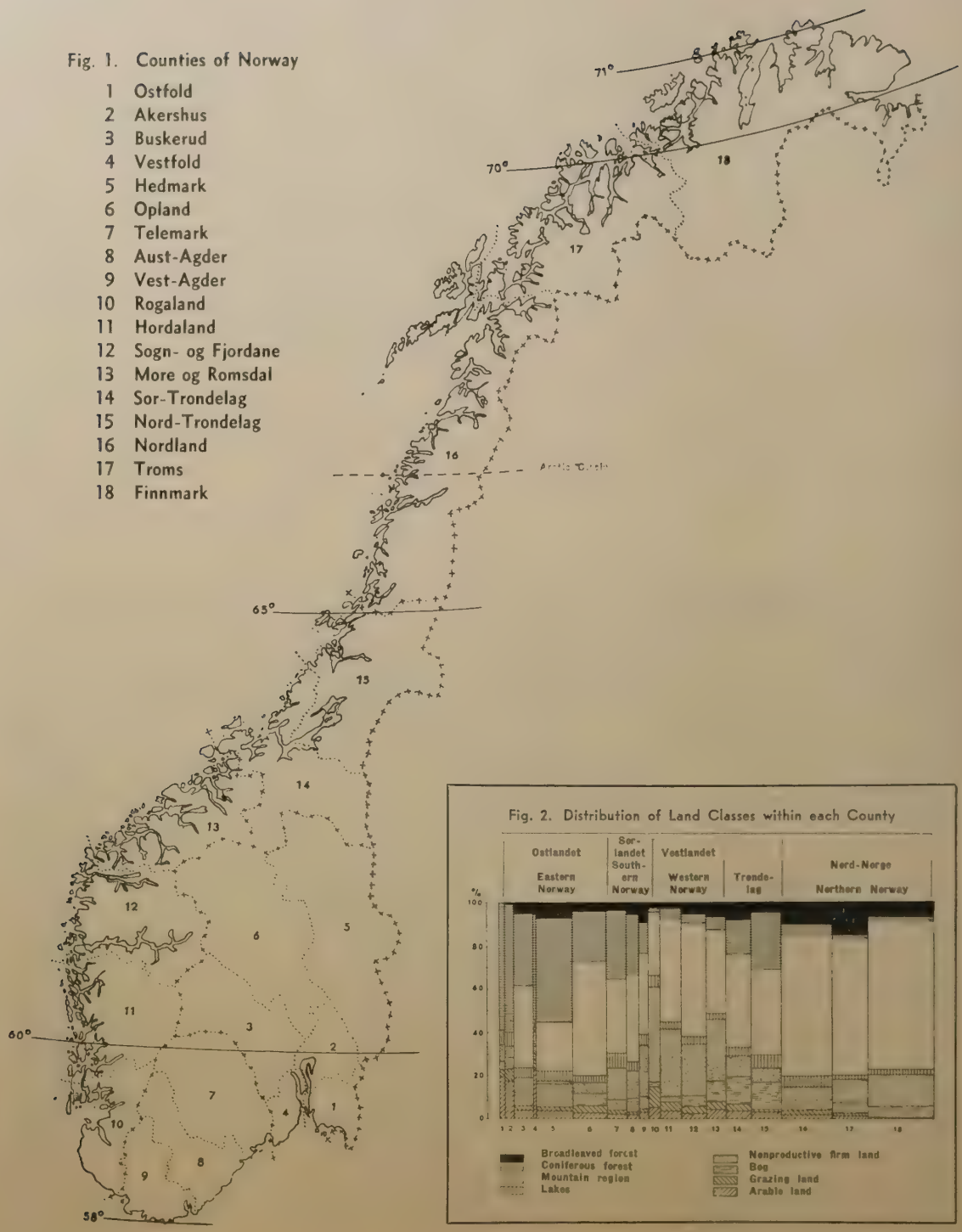
The aided-self-help formula is not new, and it is not the last word. It is "tropical housing in transition." By analyzing, planning, and organizing an aided-self-help program, many local, national, and international communities can contribute toward a solution of the basic shelter problems of 200 million tropical families.

Photos supplied by courtesy of the author

A characteristic village in semi-tropical Asia. Romantic to look at, but with earth floors, poor light, no sanitation and terribly over-crowded.

Fig. 1. Counties of Norway

1 Ostfold
2 Akershus
3 Buskerud
4 Vestfold
5 Hedmark
6 Opland
7 Telemark
8 Aust-Agder
9 Vest-Agder
10 Rogaland
11 Hordaland
12 Sogn- og Fjordane
13 More og Romsdal
14 Sor-Trondelag
15 Nord-Trondelag
16 Nordland
17 Troms
18 Finnmark



Forest Surveys of Norway

By ALF LANGSAETER

UNDER the First National Strip Survey of Norway, carried out between 1919 and 1930, the entire forest area of the country was surveyed by a special institution "Landsskogtakseringen" (Norwegian Forest Survey). The mensuration was conducted as a strip survey, and area, number of trees, volume, increment, etc., were investigated on survey strips 10 meters wide. These survey strips were drawn parallel with a constant distance between them for each county. The distance was set so as to ensure a satisfactory degree of accuracy in the results obtained for each county.

In the survey strips the area of the different site classes of productive forest land, and the area of arable land, bog, nonproductive land, etc. were determined. Within the strips the breast-high diameter of all trees exceeding 15 cm. was measured, and the trees were divided into diameter classes of 5 cm., 15 to 20 cm., 20 to 25 cm., etc. Trees ranging from 5 to 15 cm. at breast height were measured in 5-meter-wide strips, and trees under 5 cm. at breast height were measured by means of sample plots placed at fixed distances within the strips. Tree height, bark thickness, increment in diameter and height, and injuries, if any, were investigated by studies of sample trees selected systematically within each diameter class.

In 1937 a new strip survey of the forests of Norway was begun. The second survey followed the pattern of the first in most respects, but efforts were made to make use of new developments in forest survey technique. The distance between the survey strips was reduced in order to obtain more accurate results for areas smaller than counties. Thus, more detailed forest statistics for the individual parts of the country were obtained.

The method of mensuration employed in the Second National Strip Survey differed from that of the first survey.

(1) The forest land was divided into five site classes according to a common method for the whole country.

(2) The forests were divided into six cutting classes:

Class I: Stands under regeneration.
Class II: Young stands below thinning age.
Class III: Young stands that ought to be thinned.
Class IV: Older stands not yet ripe for regeneration cutting.
Class Va: Stands ripe for regeneration cutting.
Class Vb: Stands of every age, so sparse or damaged that in future they will be unable to utilize the yield capacity of the habitat.

Cutting classes II, III, IV, and Va should be of a fairly satisfactory density.

This division into cutting classes affords highly valuable material both for estimating the present condition of the forests, and for outlining measures to be taken in the future to increase the production of the forests.

(3) On sample plots placed at fixed distances in the survey strips, the distribution of age-classes, density of the stand, ground vegetation, etc. were examined.

In both the first and second national surveys the standard error was calculated in order to determine the accuracy obtained by the method chosen.[1]

Results of the First National Strip Survey

Each of the 16 counties shown in Figure 1 was surveyed separately, but the results of the survey have been summarized on the basis of the following groupings:

Eastern Norway (Counties 1 to 6)
Southern Norway (Counties 7 to 9)
Western Norway (Counties 10 to 13)
Trøndelag (Counties 14 and 15)
Northern Norway (Counties 16 to 18)

[1]Comprehensive literature is available within this field; those who might be interested are referred to the following works, which include further documentation on this subject:

A. Langsaeter, "Noiaktigheten ved linjetaksering av skog I og II" (Accuracy in strip survey of forests). *Meddelelser fra Det norske Skogforsoksvesen*, nr. 15 (1932) og nr. 18 (1934). With a short English summary.

Manfred Näslund, "Om medelfelets härledning vid linje- och provytetaxering." (On computing the standard error in line and sample plot surveying). *Meddelanden från Statens Skogsforsöksanstalt*, Häfte 31 (Stockholm, 1939). With an English summary.

Bertil Matérn, "Metoder att uppskatta noggrannheten vid linje- och provytetaxering" (Methods of estimating the accuracy of line and sample plot surveys). *Meddelanden från Statens Skogsforsknings institut*, B. 36 (Stockholm, 1947). With an English summary.

Area

The total area and the area of productive forest land are shown in Table 1, and the percentage distribution of land classes within the individual counties is indicated in Figure 2.

TABLE 1.—TOTAL AREA AND AREA OF PRODUCTIVE FOREST LAND

Region	Total area	Productive forest land: Area	Coniferous forest	Broadleaved forest
	1,000 ha.	*1,000 ha.*	*percent*	*percent*
Eastern Norway	7,950	3,462	89	11
Southern Norway	3,178	1,011	82	18
Western Norway	5,822	536	49	51
Trøndelag	4,112	1,150	79	21
Northern Norway	11,375	1,470	20	80
All Norway	32,437	7,629	70	30

Volume

The volume and volume growth found in the first, as well as in the second national survey, are expressed in solid cubic meters, excluding bark. The figures represent gross values inasmuch as no deduction has been made for tops left in the forest, decayed wood, loss in floating, etc.

Total volumes, without bark, for all coniferous trees and for broadleaved trees of more than 5 cm. d.b.h. are shown in Table 2.

TABLE 2.—VOLUME OF CONIFEROUS AND BROADLEAVED TREES

Region	Coniferous trees: Spruce *Picea*	Pine, *Pinus*	Total	Broadleaved trees	Total
	(*million cubic meters*)				
Eastern Norway	113	48	161	18	179
Southern Norway	18	20	38	10	48
Western Norway	—	10	10	7	17
Trøndelag	35	8	43	9	52
Northern Norway	5	4	9	18	27
All Norway	171	90	261	62	323

The volume of the most important broadleaved trees was distributed approximately as follows: birch, *Betula*, 79 percent; aspen, *Populus*, 8 percent; alder, *Alnus*, 6 percent; oak, *Quercus*, 3 percent; mountain ash, *Fraxinus*, 2 percent; totalling 98 percent. The remaining 2 percent was made up of willow, *Salix;* beech, *Fagus;* ash, *Fraxinus;* linden, *Tilia;* maple, *Acer;* bird-cherry, *Cerasus;* hazel, *Corylus;* and other broadleaved trees.

The percentage distribution of the volume by breast-height dimensions for the whole country is given in Table 3, and annual volume growth is shown in Table 4.

TABLE 3.—PERCENTAGE DISTRIBUTION OF VOLUME, BY DIAMETER GROUPS

	Under 10 cm.	10-20 cm.	20-30 cm.	Over 30 cm.	Total
	(*percent*)				
Spruce	9	44	38	9	100
Pine	6	35	43	16	100
Broadleaved trees	28	50	16	6	100

TABLE 4.—ANNUAL VOLUME GROWTH

Region	Coniferous trees: Spruce	Pine	Total	Broadleaved trees	Total
	(*10,000 cubic meters*)				
Eastern Norway	409	135	544	71	615
Southern Norway	70	70	140	39	179
Western Norway	—	28	28	28	56
Trøndelag	91	16	107	25	132
Northern Norway	14	5	19	44	63
All Norway	584	254	838	207	1,045

On comparing Tables 2 and 4 with Table 1 it is found that volume and increment per hectare in the forests of Norway are very low. This is chiefly due to the fact that a major part of the forest area lies close to the climatic limit of forest growth along the mountain regions, or to the north. About 1.2 million hectares of forest, or about 16 percent of the total forest area of the country, lies north of the polar circle.

The mean volume and volume growth per hectare of coniferous forest are shown in Table 5.

RESULTS OF THE SECOND NATIONAL STRIP SURVEY

Since 1938 five counties have been resurveyed, namely Nos. 1, 2, 4, 5, and 15 (see Figure 1). Some of the most important results of the second survey are shown in Tables 6 to 11.

TABLE 5.—VOLUME AND ANNUAL GROWTH PER HECTARE

Region	Volume per hectare: Spruce	Pine	Broadleaved trees	Total	Annual growth per hectare: Spruce	Pine	Broadleaved trees	Total
	(*cubic meters*)							
Eastern Norway	35	15	4	54	1.3	0.4	0.1	1.8
Southern Norway	20	22	5	47	0.8	0.8	0.2	1.8
Western Norway	0.6	34	2	37	—	1.0	0.1	1.1
Trøndelag	37	8	5	50	1.0	0.2	0.1	1.3
Northern Norway	18	12	6	36	0.4	0.2	0.2	0.8
All Norway	31	15	4	50	1.0	0.4	0.2	1.6

TABLE 6.—AREA OF PRODUCTIVE FOREST LAND DISTRIBUTED AMONG THE INDIVIDUAL SITE CLASSES

County number and name	Area, by site class 1	2	3	4	5	Total
	(1,000 hectares)					
1 Ostfold	17	46	59	54	37	213
2 Akershus	20	60	152	69	12	313
4 Vestfold	22	31	51	16	9	129
5 Hedmark	22	93	461	409	211	1,196
15 Nord Trondelag	5	30	178	173	106	492
Total	86	260	901	721	375	2,343
	(percent)					
Percentage distribution	4	11	38	31	16	100
	(cubic meters)					
Yield capacity per hectare	9.2	6.5	4.3	2.7	1.6	

TABLE 7.—AREA OF INDIVIDUAL CUTTING CLASSES

County number and name	Area, by cutting class I	II	III	IV	Va—Vb	Total
	(1,000 hectares)					
1 Ostfold	4	12	40	73	84	213
2 Akershus	5	6	62	87	153	313
4 Vestfold	7	2	16	33	[1]71	129
5 Hedmark	37	45	222	334	558	1,196
15 Nord Trondelag	9	7	52	122	[2]302	492
Total	62	72	392	649	1,168	2,343
	(percent)					
Percentage distribution found	3	3	17	27	50	100
Normal distribution	6	31	28	28	7	100

[1]5,000 hectares in Class Va and 66,000 hectares in Class Vb.
[2]25,000 hectares in Class Va and 277,000 hectares in Class Vb.

TABLE 8.—VOLUME PER HECTARE (CONIFEROUS AND BROADLEAVED TREES) IN THE INDIVIDUAL SITE CLASSES

County number and name	Volume per hectare, by site class 1	2	3	4	5	Average for all productive forest land
	(cubic meters)					
1 Ostfold	113	93	75	58	39	71
2 Akershus	117	106	77	49	34	78
4 Vestfold	122	102	78	50	39	85
5 Hedmark	130	107	69	42	23	55
15 Nord Trondelag	108	110	80	51	30	61

TABLE 9. VOLUME GROWTH PER HECTARE (CONIFEROUS AND BROADLEAVED TREES) IN THE INDIVIDUAL SITE CLASSES

County number and name	Increment per hectare for each site class 1	2	3	4	5	Average for all productive forest land
	(cubic meters)					
1 Ostfold	6.2	4.6	3.0	1.8	1.1	3.0
2 Akershus	6.6	5.0	2.9	1.4	0.8	3.2
4 Vestfold	6.7	4.8	3.1	1.7	1.2	3.8
5 Hedmark	7.2	5.1	2.6	1.3	0.6	2.1
15 Nord Trondelag	5.5	4.4	2.6	1.3	0.6	1.9

TABLE 10.—VOLUME PER HECTARE (CONIFEROUS AND BROADLEAVED TREES) FOR THE INDIVIDUAL CUTTING CLASSES

County number and name	Volume per hectare for each cutting class I II	III	IV	Va	Vb	Average for all productive forest land
	(cubic meters)					
1 Ostfold	40	73	86	(64	)	71
2 Akershus	20	70	112	(66	)	78
4 Vestfold	27	103	138	154	57	85
5 Hedmark	21	57	85	(42	)	55
15 Nord-Trondelag	18	68	95	119	41	61

TABLE 11.—VOLUME GROWTH PER HECTARE (CONIFEROUS AND BROADLEAVED TREES) IN THE INDIVIDUAL CUTTING CLASSES

County number and name	Increment per hectare for each cutting class					Average for all productive forest land
	I-II	III	IV	Va	Vb	
	(cubic meters)					
1 Ostfold	2.7	4.0	3.5	(2.1	)	3.0
2 Akershus	1.6	4.2	4.5	(2.1	)	3.2
4 Vestfold	1.4	6.2	5.8	4.3	2.6	3.8
5 Hedmark	1.2	3.1	3.0	(1.2	)	2.1
15 Nord-Trøndelag	0.9	2.9	3.2	2.9	1.1	1.9

TABLE 12.—VOLUME AND INCREMENT; COMPARISON BETWEEN FIRST AND SECOND NATIONAL SURVEYS

County number and name	Year of survey		Total volume of spruce and pine (second survey)	Increase in volume between the surveys			Total growth of spruce and pine (second survey)	Increase in growth between the surveys		
					In percent of				In percent of	
	First survey	Second survey		Increase	First survey	Second survey		Increase	First survey	Second survey
			1,000,000 m³	*1,000 m³*	*percent*	*percent*	*1,000 m³*	*1,000 m³*	*percent*	*percent*
1 Ostfold	1919	1937	14	3,151	32	22	602	143	31	24
2 Akershus	1920 1921	1939	23	3,050	16	13	962	112	13	12
4 Vestfold	1922	1946	9	2,918	44	31	435	132	44	30
5 Hedmark	1920	1938 1940-41	64	3,806	6	6	2,455	302	14	12
15 Nord-Trøndelag	1921	1942-45	28	439	2	2	878	135	18	15
Total[1]	.....	.....	138	13,364	11	10	5,332	824	18	15

[1]The total increment for these five counties constitutes about one-half of the volume growth of all the forests of Norway.

COMPARISON OF RESULTS

On comparing Tables 8-11 with Table 5 it will be seen that the five counties resurveyed show considerably higher volumes and increments per hectare than the averages shown for their respective districts in the first survey (Table 5). Some of the causes for this are:

(1) The five counties resurveyed belong to the best forest counties and rank higher as to volume and volume growth per hectare than do the forests of Norway on the average.

(2) Fairly large areas of land have such a low yield capacity that they belong somewhere between productive forest land and nonproductive land. The qualifications for inclusion of a given stand under productive forest land were defined more closely in the second survey, and according to more rigid rules. As a result, the area of productive forest land found in the second survey is somewhat less than in the first, and the mean volume and the mean volume increment per hectare are somewhat greater.

(3) Part of the increase found is due to the use of improved methods of calculation in the second survey.

(4) The growing stock and increment of the forests of Norway have increased during the interval between the first and second survey.

This last factor is illustrated in Table 12 by a comparison between the two surveys with regard to the total volume and the total volume growth of coniferous trees (spruce and pine).

By this comparison the results of the first survey are corrected in such a way that they are directly comparable to those of the second survey.

The encouraging increase in volume and volume growth is probably due to several factors:

(1) The mean annual felling in the years between the two surveys has been somewhat less than the volume growth. This circumstance, however, can only partly explain the increase.

(2) Some of the increase in increment is due to draining of bogs and waterlogged forest land. The area of productive forest land, on the other hand, has become somewhat reduced by new cultivation (arable land and cultivated pasture). The forest production gained by draining, however, exceeds that lost to agriculture. The net increase of all this hardly amounts to 10 percent of the apparent total increase in increment.

(3) The growth of the forest for the individual years varies with the climate (summer temperature, precipitation, etc.). In the two surveys carried out the increment has been calculated by means of the widths of the tree-rings for 10 years preceding the surveys. Climatic changes occurring between these

two 10-year periods may, therefore, account for some of the increase in volume growth.

Material required for an accurate estimate of the effect of this factor is lacking. According to investigations so far, only part, and probably a small part, of the increase in volume growth can be due to climatic variations.

(4) A considerable part of the increase in increment is due to more rational forest management during the last 20 to 25 years.

Measures for Increasing Forest Output

In spite of the considerable increase in volume and increment during the last 20 to 25 years, the condition of the forests in Norway is by no means what it ought to be. The division into cutting classes shows that for the five counties resurveyed since 1937, class Vb occupies more than 40 percent of the total area of productive forest land. This means that in these counties about 40 to 50 percent of the forest area has an unsatisfactory growing stock and increment. The future production of these areas can be increased considerably by improved forest management.

The total increment in the forests of Norway in the course of 50 to 60 years can be increased by about 50 percent. If the annual felling quantity in the transition period corresponds to the mean felling quantity in the years preceding World War II, this great increase in growth may still be within reach. If, on the other hand, the felling quantity is increased much beyond this level the wood-manufacturing industries may be faced with a timber shortage within 20 or 30 years.

The restoration of the forests will require a large amount of capital and working power. Very comprehensive forest cultivation is required to create satisfactory regeneration and to establish young stands in many of the forests which at present have but a small production and grow under difficult conditions of regeneration. The Government Forestry Board of Norway has been working for a long time to promote forest production. Under the Forest Protection Act of 1932 and the Reforestation Plan of 1937, the work has been mapped out by the Director of Forestry.

The Forest Protection Act provides that no cutting shall take place in younger stands, except when it is conducive to the further development of the stand. Cuttings in older stands shall not be performed in such a way, nor shall the ground be so treated after cutting, that these activities spoil or endanger the natural regeneration of the forests. As long as the Forest Control Officer finds that the forest owner works his forest according to the rules of good forest management, the forest owner shall have the right to

View of forest in Stor-Elvdal, Hedmark county

Pine forest in Buskerud county. The trees are about 140 years old, the standing volume 450 m^3 per hectare. By a thinning just carried out 140 m^3 were cut per hectare. The annual increment is 7 m^3 per hectare.

manage his own forest. If the Control Officer finds that the forest owner is not complying with these rules in his cutting, he can prohibit cutting, order forest management by forest control officers, or order artificial regeneration. Under this law the private forest owner is free to manage his forest in his own way, provided he possesses a sufficient sense of responsibility. This course of action seems to lead to better results than the use of direct compulsory measures.

Other measures put into effect by the authorities for the intensification of forest management include:

(1) Information work and guidance of private forest owners by forest control officers.

(2) Payment by forest owners of 2 percent of the gross value of all timber sold or used for industrial production. The funds accruing from this source are paid back to the forest owner as soon as he carries out artificial regeneration.

(3) Direct subsidies by the government for: (a) forest cultivation, up to 50 percent of cost, and (b) building of forest motor roads.

By these measures, and others, the authorities have attempted to bridge the gap previously existing between forestry as a private and as a public enterprise. In this way an attempt is made to prepare the ground so that a method of forest management considered expedient from the point of view of public utility will also prove the most profitable one for the private forest owner.

The efforts made by the authorities brought good results during the prewar years. The area of artificial regeneration greatly increased from year to year up to 1940. During the war there was a heavy decline in forest cultivation activities. Simultaneously the occupation forces during the last years of war carried out a number of large clear cuttings. This was especially the case in the northernmost parts of Norway, but in southern Norway large clear cuttings also took place, particularly in the forests adjoining railways and roads.

When the war came to an end there was a greater need for forest cultivation than ever before. Difficulties arose from the manpower shortage and from various other circumstances attendant on the war. Nonetheless, great efforts are now being made to increase forest production through intensifying silvicultural treatment and improving forest management as a whole.

Photographs by courtesy of the Norwegian Forest Service

Commodity Reports

Plywood

FOR many decades after the establishment of the first plywood-producing plants about the middle of the last century, the plywood industry was almost an "offshoot of lumbering," but it has recently grown to be an important and independent branch of the woodworking industry.

Plywood consists of sheets of wood material made up from three or more layers of veneer glued or cemented together, the grains of adjoining plies usually being at right angles to one another. Laminboard, blockboard, and batten board are sometimes included as plywoods.

New uses for plywood are continually being found in construction, joinery, millwork; in manufacture of airplanes, small boats, cars, etc.; and in innumerable other fields. The merits of plywood have been greatly increased by new achievements in glueing (e.g., use of synthetic resins, electronic short-wave heating); by the development of techniques for bending and molding plywood; and by the use of special new wood and paper products, metals, and plastics for surfacing of plywood. These methods have made it possible to produce, at a comparatively low cost, plywood which is waterproof, strong, durable, and resistant to temperature extremes and abrasions. Inasmuch as the field for plywood is almost incessantly widening, the supply does not equal demand.

Production

Before the second world war, the world output of plywood was estimated at 2 million m³ per annum, nearly 40 percent of which was produced by the United States of America. Europe produced approximately 90 percent of its own requirements.

The prewar volume in plywood production was exceeded in 1945 and surpassed by a large margin in 1946. For countries reporting to FAO, listed in Table 1, 1947 plywood production of 2.9 million m³ was 18 percent more than in 1946. The United States, Canada, Finland, and Japan were responsible for 74 percent of total production.

Complete figures on plywood production in 1948 are not yet available; those reported so far indicate that production was in excess of 3 million m³.

Europe

The war had severe effects upon the European plywood industry. The plywood market was disorganized. Some plants were damaged, and others were made idle by shortages of raw material, fuel, and glue. In some countries, where the plywood factories could be kept running, production was standardized primarily for the manufacture of prefabricated houses.

Since the end of hostilities, European plywood production has been rapidly recovering. This has been the case in Finland especially. In spite of the loss, by peace treaty with the U.S.S.R., of four mills with a production potentiality of about 45,000 m³ of plywood per annum, and in spite of the need to modernize mill equipment, Finland still holds first place among European suppliers. Italy and Czechoslovakia have been able to increase plywood production. In France the plywood industry suffered during the war from curtailed supplies of okoumé logs from Africa, but production is recovering and has almost reached its prewar level. In the group of traditional European ply-

TABLE 1.—WORLD PLYWOOD OUTPUT

Country	Prewar Level	1945	1946	1947	[1]1948
	(Thousand cubic meters)				
Europe					
Czechoslovakia	...	...	27	51	...
Finland	225	90	140	192	210
France	90	24	44	67	86
Germany: Bizone	...	...	75	71	106
Italy	10	...	25	55	80
Netherlands	5	...	...	33	32
Poland	...	2	8	18	32
Sweden	29	31	33	30	35
Switzerland	—	12	18	21	11
United Kingdom	4	44	40	38	34
Near East and North Africa	...	...	10	10	10
North America					
Canada	...	200	192	235	294
United States	750	[2]1,081	[2]1,275	[2]1,505	[2]1,740
Latin America					
Brazil	...	[3]87	[3]110	[3]90	...
Africa	...	...	10	10	10
South and East Asia					
India	...	...	12	...	...
Pakistan	...	...	[4]116	...	...
Japan	290	34	152	190	...
Oceania					
Australia	35	...	48	49	46
New Zealand	...	9	10	10	11
ESTIMATED TOTAL	2,000	1,950	2,420	2,850	3,200

... Not available.
— None or very small.
[1]Preliminary figures.
[2]Only data for production of softwood plywood; figures for hardwood plywood are not available. United States production of hardwood plywood totaled 550,000 m³ in 1944.
[3]Does not include plywood consumed in the manufacture of furniture, boxes, etc.
[4]Year 1946/1947.

wood suppliers, Bizone Germany and Poland have been able to raise their production to considerable volumes.

The gap between supply and demand, evident during and after the war, has stimulated various countries, which formerly had comparatively small or no production facilities, to establish new plywood plants. Among these, Switzerland and the United Kingdom have shown the most striking increases in plywood manufacture.

Owing to the relatively high prices of imported logs from which they produce most of their plywood, the United Kingdom and the Netherlands are now exploring the possibilities of supplying their plants with indigenous species. The plywood industry of most of the western European countries has relied chiefly upon imports of raw materials, and large-scale production of domestic softwood plywood cannot be appreciably expanded.

U.S.S.R.

The plywood industry in the U.S.S.R., located chiefly in the western and northeastern areas of the Russian Soviet Federated Socialist Republic and in the Byelorussian Soviet Socialist Republic, is reported to have suffered heavily from war and occupation. The Baltic republics exported considerable quantities before the war, but their plywood production is now absorbed by the U.S.S.R. No data are available on plywood production in the U.S.S.R.; however, it is known that the current five-year plan provides for an increase of veneer output, calculated to reach a volume of 810,000 m^3 in 1950, an 11 percent increase over the 1940 level.

North America

In contrast to what happened in Europe, the last decade was a period of real expansion for the plywood industry in North America, notably in the United States. The Canadian and United States plywood industries had to satisfy not only the unprecedented demands of domestic construction and industry but also a large part of the heavy overseas requirements.

In the United States, Douglas fir plywood production rose from 130,000 m^3 in 1925 to 880,000 m^3 in 1939 and to 1,500,000 m^3 in 1942. Having undergone a period of diminished output under wartime conditions, this industry, which comprised 42 factories in 1948, has achieved a 70 percent increase of production since the end of the war.

There are in the United States over 600 hardwood veneer plants varying in size and widely dispersed throughout the eastern region of the country. The hardwood plywood output in 1944 totaled 550,000 m^3 and was estimated in 1948 at 5.1 million m^2 (55 million sq. ft.).

Latin America

In general, plywood manufacture in Central and South America is, as yet, comparatively little developed. Some Latin-American countries have plywood industries which produce considerable material for local consumption and, to some extent, for export as well. In most cases, cold press methods with casein glue are used, but recently some modern plants have come into operation and others are about to be installed.

In Brazil, where the first plywood factory was built in 1928, there are at present 280 veneer and plywood plants. However, only 40 plywood plants, 29 veneer plants, and 61 mills manufacturing both veneer and plywood are in current operation, and not more than 30 or 40 among them can be regarded as modern. The major part of this industry is situated in the State of Paraná. The total capacity of the plywood plants is estimated at about 125,000 m^3 per year. Ninety percent of Brazilian plywood is made from Paraná pine, but there are large possibilities, both actual and potential, of using a variety of other species as raw material. The quality of Brazilian plywood can be expected to improve shortly, as a result of the recent completion of a modern glue factory which is claimed to have sufficient capacity to satisfy, with synthetic adhesives, all the glue requirements of the country's plywood industry.

The production capacity of the plywood industry in Argentina (with some 12 to 14 mills), Chile (4 mills), Bolivia (1 plant), Paraguay (1 plant), Venezuela, and Mexico (3 plants) is not available.

A modern plywood mill has been put into operation recently in Surinam. Its production, based on *Virola surinamensis* (baboen or banak), will be chiefly exported.

Near East

During the past few years plywood production in Turkey amounted to about 7,000 m^3 per annum. Turkey is the only Near Eastern country which has made a real start in plywood manufacturing although Egypt and some other countries may produce small quantities.

Oceania

In this region the development of the plywood industry has been hampered by the decline in stands of hoop pine, which used to be the main raw material. However, eucalyptus and other hardwood species have been taken into use.

Before the war, there were 23 plywood mills in Australia with an annual output of 12 million m^2 (129 million sq. ft.). Australian plywood production, which increased after the war to a peak volume of 49,000 m^3 in 1947, declined somewhat in 1948.

New Zealand has been gradually expanding her young plywood industry, and production attained a volume of 11,000 m^3 in 1948.

South and East Asia

In India and Pakistan, where the requirements of plywood for tea chests alone amount to as much as 7.5 million m^2 (80 million sq. ft.) annually, the plywood industry was greatly increased during the war. Since then, the output of plywood has dropped considerably as a number of plants were adversely affected by foreign imports and had to close. At present there are about 80 factories in India and Pakistan. It is estimated that under proper management the plants can produce over 9 million m^2 (97 million sq. ft.). The output is impaired, however, by insufficiency of casein production and lack of skilled technicians.

In Ceylon there is a government-owned plywood factory which produces 370,000 m^2 (4 million sq. ft.) of tea chest plywood, and one modern privately owned mill with an annual capacity of 46,000 m^2 (500,000 sq. ft.) of plywood.

Before the war, Japan was a considerable supplier of plywood for the world market. Since the end of hostilities the Japanese plywood industry has been gradually recovering; production amounted to 190,000 m^3 in 1947. There are at present some 200 plywood factories in operation.

Korea had three active plywood mills in 1947, with an annual capacity of nearly 420,000 m^2. Malaya, a timber exporting country, started plywood production in 1948 with one modern plywood mill producing tea chests and wall panels. Indochina has one veneer and plywood factory in operation.

Africa

The plywood industry of the Union of South Africa, consisting of two factories which were established in the 1920's, has been dependent on imported veneer logs, such as okoumé from French West Africa and kiaat from the Belgian Congo. The yearly production amounts to about 1.3 million m^2 (14 million sq. ft.).

During the past few years there has been a strong tendency to develop veneer cutting and plywood manufacturing capacity in tropical territories where different kinds of hardwoods are available.

An interesting postwar development is the establishment of a plywood industry in the French tropical territories. This industry will use local logs of the type previously exported in large quantities to Europe and the United States, and in addition, new species which have not yet been exploited. In French Equatorial Africa, where okoumé is the chief raw material, three plywood plants are now in operation and three additional plants are under construction. The difficulties in obtaining sufficient manpower have been alleviated by an agreement providing for recruitment of labor from Nigeria to Gabon.

Steps are also being taken to develop plywood industries on the Ivory Coast and in the Cameroons.

In order to encourage the partial processing of timber before export, the British have stimulated the setting-up of local veneer and plywood factories in Nigeria and on the Gold Coast.

In addition to French tropical territories, and British Nigeria and the Gold Coast, the Belgian Congo, which produces Korina timber, has recently become a plywood producer. This has come about by the activity of the United States plywood industry, which has also shown interest in the production of veneer products in the African Gold Coast.

Trade

Exports

Before the war, world export trade in plywood was dominated by Finland which exported about 30 percent of the total, by the U.S.S.R. which exported about 25 percent, and by Poland and the Baltic countries, each of which exported roughly 15 percent of the total. So far, only Finland has regained her position on the plywood export market. Finland's exports have increased during the past few years, partly because of the gradual decline in the volume of war reparation deliveries to the U.S.S.R. There are, however, indications that Poland may, in a few years, also be able to resume plywood exports. The recent trade agreement between the United Kingdom and Poland provides for imports of a total of 1,200 m^3 of Polish plywood to the United Kingdom during the years 1949-1951.

Since 1940, western European requirements of plywood have been met to a great extent by supplies from Canada, the United States, and Brazil. Exports from the United States and Canada amount to a considerable volume, but it is interesting to note that in 1948 only 0.8 percent of the total fir plywood production of the United States was exported, whereas for the same period Canadian plywood exports corresponded to 29 percent of production. Under normal conditions, Brazil exports 60 to 70 percent of production, and Finland about 95 percent, although domestic consumption of plywood in Finland during the last few years has amounted to about 10 percent.

For countries listed in Table 2, exports rose about a third between 1946 and 1947. As in prewar years, Finland again is seen to be the major exporter. Exports from the United States were subject to considerable fluctuations and in 1948 appear to have declined even below prewar levels. Japan has disappeared from the rank of exporters, but Brazil has entered the picture and exports from Canada have become of increasing importance.

Table 2.—Plywood Exports

Exporting Country	Prewar Level	1945	1946	1947	1948
	(*Thousand cubic meters*)				
U.S.S.R.	175	...	...	...	..
Baltic countries	115			—	—
Finland	200	72	136	173	187
Sweden	12	20	21	17	18
Poland	100	—	—	—	—
U.S.A.	23	114	57	111	13
Canada	...	73	64	80	85
Brazil	—	31	38	45	...
Japan	50	—	—	—	...
Total	675	310	316	426	...

... Not available.
— None or small.

Imports

The United Kingdom has traditionally been the greatest plywood importer by a large margin, followed by the Netherlands, Belgium, and Argentina. These countries, with the United States and Denmark, in recent years have purchased the bulk of the plywood launched on international markets.

It is obvious that the international plywood market has not yet attained any form of lasting stability. For example, whereas up to 1947 the major part of plywood imports of the United Kingdom was furnished by Canada and the United States (about 23 percent and 35 percent respectively in 1947), the acute shortage of dollar currency prevailing in the United Kingdom forced it to limit drastically purchases of plywood from the United States during 1948 and to reduce imports from Canada. At the same time, the United Kingdom discontinued plywood purchases from Brazil, which had previously supplied considerable quantities (15,000 m^3 in 1947).

The United States has increased its imports of plywood from Canada. The United Kingdom, as well as other importers, is looking for supplies from new sources, such as Central Africa and Japan.

The main importing countries and the respective volume of imports are shown in the following table:

TABLE 3.—PLYWOOD IMPORTS

Importing Country	Prewar Level	1945	1946	1947	1948
	(Thousand cubic meters)				
United Kingdom	335	238	217	261	175
Netherlands	43	...	10	26	31
Belgium	35	2	18	20	22
Denmark	20	8	17	13	5
United States	...	1	21	33	38
Argentina	20	23	35	...	...
TOTAL	453	272	318	[1]383	[1]301

... Not available.
[1]Estimated total.

Prices

Prices of plywood have increased throughout the whole world during the last decade. In most producing countries, they are about three times higher on the domestic market than they were before the war. Plywood prices in the United States declined during 1948 but are reported to have stabilized towards the end of the year. In Finland, on the other hand, plywood production costs have steadily risen during recent years and at some mills have exceeded the prices obtained on the market.

Plywood prices have also risen on the international market. According to official British sources, the average c.i.f. import values of plywood (including laminboard, blockboard, and batten board) received by the United Kingdom have risen by 305 percent between 1938 and 1948. The average values of birch plywood increased 398 percent, and the average values of other plywood, 198 percent.

Lately, however, there have been indications of a break in the rising trend of plywood prices. Comparison between average c.i.f. values paid by importers in the United Kingdom in 1947 and 1948 shows an average decline of nearly 4 percent during this period. The slight drop in prices of plywood imported from Canada and the United States offsets the rising trend in the average import values of plywood of Finnish, Swedish, French, and other origin.

Future Trends

"Supplies of veneer-quality timber are limited in the Northern Hemisphere, especially as regards the clear, virgin softwoods that are contributing too heavily to the volume of cheap plywood being manufactured" and, therefore, the trends probably will be: a) pruning of trees for the production of veneer logs, b) new methods of producing satisfactory veneer from small logs, and c) utilization of tropical hardwoods for plywood.[1]

In the United States, where, in 1944, 58 percent of the timber used for veneer and plywood was hardwood, there are current or imminent shortages of logs suitable for face veneer, but there are still sufficient hardwood logs in the country for container veneer which does not have to meet such high standards. On the other hand, the U. S. Department of Agriculture has come to the conclusion that the U. S. softwood plywood industry does not presently own enough timber lands to maintain its output and has to purchase its additional log requirements. The Douglas fir industry, in particular, will have to adapt itself to new conditions by using raw material of poorer quality than heretofore, causing more direct competition between plywood and lumber mills for log supplies.[2] There are still some possibilities of increasing softwood plywood production in the United States.

The northern European countries, which use pine, birch, spruce, and, to a minor extent, aspen, alder, beech, and oak, etc., for veneer and plywood, are suffering from difficulties in maintaining the quality of birch veneers on a satisfactory level. In Sweden there is a shortage of birch logs suitable for plywood; consequently, home production has to be supplemented by the import of considerable quantities of birch plywood from Finland. On the other hand, there are possibilities of extending the output of softwood plywood in Sweden. The Swedish plywood industry, consisting at present of seven plants, will be enlarged by a new factory producing plywood for export, which is expected to enter into operation during the current year. In Finland the possibilities of increasing the output much beyond the present level are considered to be very limited because of the shortage of suitable raw material.

In central Europe, Czechoslovakia and Austria are the countries where the plywood industry can be developed further. Austria, in particular, has great natural resources and it is estimated that by establishing a few big plants the Austrian plywood output (about 8,000 m^3 in 1948) could be increased ten to fifteen times in the course of four years. If this is accomplished, exports could reach 100,000 m^3 per annum.

Eastern European countries have launched plans providing for development of their woodworking industries. According to the Yugoslavian plans for 1947 to 1951, the country's plywood production in 1951 ought to reach a volume of 48,000 m^3, an increase of more than 250 percent compared with production in 1939. The current Bulgarian five-year plan aims at an output of 700,000 m^3 of veneer in 1953. The actual projects of the Ministry of Forestry in Poland involve the establishment of eight plywood factories. In the U.S.S.R. the five-year plan provides for construction of new veneer mills in the Karelian-Finnish S.S. Republic, the Komi S.S. Republic, Krasnoiarsk district, and Novgorod, Molotov, and Timmen regions, with a total capacity of 300,000 m^3, as well as for restoration or expansion of a number of existing plants and for construction of 53 new glue presses.[3]

The possibility for a considerable increase of a competitive plywood industry in the western countries of Europe is small. For example, a committee appointed by the British Board of Trade to consider the United Kingdom's probable requirements and supplies of timber and plywood during the period of the next five years has, in its recently published report, assumed that whereas the plywood supplies of the United Kingdom were estimated to increase from 65.2 million m^2 (702 million sq. ft.) to 99.5 million m^2 (1,071 million sq. ft.) from 1949 to 1953, the domestic plywood production will be maintained at 6.7 million m^2 (72 million sq. ft.) during the same period. It is estimated that the output of the existing plywood factories in France (about 30) can be increased to approximately

[1]J. Alfred Hall, Director of the Pacific Northwest Forest and Range Experiment Station, U. S. Forest Service, "Forest Utilization," *Unasylva*, Vol. I, No. 1.

[2]*Forests and National Prosperity*, U. S. Department of Agriculture, 1948, pp. 57, 58.

[3]The Finnish-Soviet agreement on war reparation deliveries, signed in December 1944, provides for the delivery to U.S.S.R., during the indemnity period which has been prolonged until 1952, of 6 completely equipped plywood plants, including power plants, with an annual capacity of 12,000 to 15,000 m^3 each.

120,000 m^3 per annum, which would satisfy domestic requirements and leave a certain amount for exports also.

To obtain large supplies of plywood, Europe is looking to other areas and is particularly interested in the development of veneer and plywood cutting in tropical territories. For French interests, an American company is building at Port Gentil, French Equatorial Africa, a most modern plywood mill which, with its estimated monthly capacity of 930,000 m^2 (10 million sq. ft.), will probably become the largest hardwood plywood plant in the world. According to French sources, the program for plywood output from French tropical territories has been drafted as follows:

Ivory Coast	30,000 m^3 per annum
Cameroons	50,000 m^3 per annum
French Equatorial Africa	75,000 m^3 per annum

It is believed that these figures can easily be exceeded in the future.

The second largest plywood factory in the whole of Africa will be the one erected in Elisabethville, Belgian Congo. This plant will supply the entire domestic requirements and will also produce for export.

It is expected that considerable efforts will be made in the near future for development of the plywood industry in Latin-American countries, a subject to which much attention was paid by the FAO Latin-American Conference on Forestry and Forest Products, at Teresopolis in April 1948. The Paraná pine and other timber reserves in Brazil constitute a valuable basis for the extension of the country's plywood industry, which at present is in need of modernization and is hampered by an inadequate transportation system. A Swedish plywood company is setting up a modern subsidiary plant near Buenos Aires, Argentina, to be ready to start production soon. There are plans for the construction of a factory for the production of high-quality hardwood plywood in Guatemala.

In India, the Philippine Republic, Australia, and New Zealand, there are plans to increase plywood production, and it is believed that Japan will soon be in a position to resume her role as an exporter of great importance.

The Work of FAO

European Forestry and Forest Products Commission

Survey of present-day trends in European forest policy—Review of statements submitted by the Member Countries to the First Session of European Forestry and Forest Products Commission

THE essential purpose of the European Forestry and Forest Products Commission is the co-ordination, on a regional basis, of the forest policies of the countries of Europe. At the first meeting of this Commission in July 1948, each of these countries, therefore, submitted a short report giving a general outline of the major trends of its present forest policy.

These reports do not always discuss exactly the same points. A certain amount of variation was apparent in them because the representatives of some countries submitted a rather complete report on the entire forest policy of their respective countries, while others limited themselves to replying to the three main points raised by the Chairman of the Commission, namely: the possibilities of improving present methods of utilization of forest products; the possibility of increasing the production of timber and industrial wood; the prospects for enlarging the area of productive forestlands.

Although the Commission intends later to extend its research to specific points of special interest, it already has before it some interesting and valuable data to study more closely in order to sift out the major trends.

The following summary covers certain points which appeared to be the most striking upon reading these reports.

Forest legislation

In all European countries the Government exerts, at least theoretically, some control over national forests as well as over forests belonging to their respective States, districts, villages, and other public au-

thorities This makes it possible to apply good silvicultural practices to these forests, and, on the whole, subject them to regular management.

The problem which arises in these countries consequently is in connection with privately owned forests, which almost everywhere constitute a very large portion of the forest area. Some reports mention that their yield is considerably lower than that of forests subject to Government control.

The lines along which European countries have directed their policies in order to solve this problem vary considerably. The 1945 agrarian reform in Hungary brought all forests larger than 57.55 hectares under Governmental ownership and requires all private owners of forests to obtain advance authorization from Government forestry authorities before felling timber on their lands. In other countries such as Switzerland and Denmark, the principle has been long established that the territory will maintain the existing forest cover as a whole and this necessarily means a strict control of all cutting. The Austrian system requires the employment of a qualified forester in privately-owned forests over a certain size.

Although the establishment of a working plan is rarely made obligatory for private forests, many countries, such as Norway, Ireland, etc., control not only the volume of trees felled, but also logging methods in privately-owned forest stands. In 1932 Norway created a special agency devoted solely to the supervision of the privately-owned forests.

To encourage the application of the best silvicultural methods in privately-owned forests, subsidies or low-interest loans are frequently granted to landowners for the purpose of promoting the artificial regeneration of forests following fellings, the reforestation of denuded lands, drainage work, the construction of roads, etc. In 1948 the Swedish Parliament passed an important law to this end. In Finland, similar measures were taken. The Netherlands also grant loans or tax exemption for this purpose. Great Britain and France have evolved an important program which has been given wide publicity in articles and news items. Generally speaking however, except in France, it seems that any special privilege granted to private owners is accompanied by more or less strict control measures.

Many countries have also been faced with the difficult problem of parcelling out privately-owned forest property. Some countries have prohibited the dividing up of land plots. Others favor the formation of co-operatives for the purpose, not only of facilitating the disposal of their products by forest owners, but also the application of recommended silvicultural methods.

To summarize briefly modern trends in forest legislation, the idea which has become increasingly current in Europe is that the private owner of forestlands should be held responsible for the proper care of this resource, so essential to national economy, and that, therefore, the control of the State over the management of this resource is justified in return for technical and possibly financial assistance which the State should be prepared to offer such private owners.

Silviculture

(a) *Inventories.* Many countries are obviously preoccupied with the question of forest inventory-taking. Some of them are at present undertaking the revision of their management plans, which has become so necessary due to the wartime exploitation of European forests. This naturally entails inventory-taking. In Germany, the Occupation Authorities undertook a general inventory in 1946, the results of which have already been submitted to the European Commission. Sweden regularly takes a country-wide inventory every 15 years, and is therefore in the advantageous position of being able to formulate its forest felling policy on the basis of precise data, as is indicated in its report. This is not the case in many other European countries. However, recognition of the importance of a detailed inventory covering all forest resources in each country seems to be growing more and more evident.

(b) *"Monocultures" or single species plantations of softwoods versus mixed forests.* With striking unanimity all countries of Central Europe condemn pure species plantations or "monocultures" of softwoods and are seeking to remedy the results of the previous application of such a policy in their own forests. Poland intends to eliminate the use of the clear-cutting method and to substitute in its forests the method of selective felling and restocking, i.e. the "jardinage" system. Czechoslovakia, Austria and Switzerland point out the very grave dangers of establishing softwood "monocultures." Although the representative of the French Zone of Germany is of the opinion that this type of silviculture "achieves the goals it sets for itself perfectly," he qualifies this statement by calling it "abnormal" and recommends "a less regimented type of forestry, the extension of natural regeneration, the continuous practice of thinning out of forests and the establishment of mixed stands." Belgium also mentions that the disadvantages of the clear-cutting method and of homogeneous softwood forests have already been recognized in that country.

The report of the representative of Great Britain stands in direct contradiction to the preceding statements, however; Great Britain's vast reforestation plan revolves upon the use of softwoods. Although to a lesser degree, the statement of the French representative regarding the plantation of softwoods in coppices is also in contradiction to the previous statements.

This is a serious matter, and its effect on current reforestation plans may be extremely significant; it therefore requires the closest study by the Commission.

(c) *Insects.* Many countries refer to the damage caused by recent insect infestation. The *Ips*, as well as the *Liparis monacha* in a more limited area, are obviously the most menacing of these insects. The fact that infection centers coincide precisely with those countries in which the "monoculture" of softwoods has been developed to the greatest extent, further emphasizes the significance of the question referred to in the previous paragraph. The problems of insect invasions as well as of the propagation of tree diseases are indisputably international problems.

(d) *Felling Prospects.* All countries, even those which have not been directly affected by the war such as Sweden and Switzerland, stress the definite overcutting of their forests or express their desire to increase the size of their standing timber resources; this will probably entail a temporary reduction in

fellings. However, nearly all express the hope that the measures being taken to counterbalance fellings will make possible the exploitation of a larger volume of wood than was extracted from their national forests in prewar days after a more or less prolonged period of decreased production. France even hopes that if its reforestation plan produces the anticipated results, it will be in a position to increase the present volume of its fellings by 500,000 m^3 in 1952.

(e) *Reforestation Plans.* Almost all countries of Central, Southern and Western Europe have formulated reforestation plans, some of which are extremely important and have already been mentioned.

In some countries, such as the Netherlands, a high value is ascribed to the planting of trees along highways and canals, and in other countries, particularly Hungary, to the planting of windbreaks.

The value of plantations of poplars has been pointed out by several representatives, particularly by the Italian member. This fact fully justifies the work initiated with such excellent results by the International Poplar Commission.

The chief non-European trees which are used for reforestation purposes are the Douglas fir, *Pseudotsuga taxifolia*, Sitka spruce, *Picea sitchensis*, and several other species obtained from the western part of North America, as well as *Larix leptolepis*, Japanese larch.

In connection with these reforestation plans special importance is attached to the collection of certified seeds, to the propagation of tree species adapted to their sites and, in general, to problems of forest genetics, upon which the attention of European silviculturists appears to be concentrated at the present time.

Problems relating to soil utilization. Although several other countries have called attention to the extent of their mountain reforestation projects with the specific end in view of flood control, only Italy's report is principally concerned with this very important question, of vital importance for all Southern European countries.

Therefore this report is of special interest not only for the exposition of problems arising in that country, but also in view of the measures being taken to solve these problems.

It was upon the suggestion of the representative of Italy that the European Commission set up a Subcommission on Mediterranean Problems. This Subcommission met in Rome, in December 1948, upon the invitation of the Italian Government, to initiate the study of questions peculiar to this region.

The exploitation of forests and the processing and utilization of forest products. Delegates of European countries represented on the Commission generally appear to be less concerned with these questions than with silvicultural methods, and from their reports, it is not possible to gain a sufficiently complete idea of the situation in these respects.

Although the majority of countries have taken at least indirect measures to control the waste of certain forest products, especially by means of controlled building programs, the rationing of paper consumption, etc., there is no similar trend to control the intermediary stages of utilization of forest products.

Preference is given government-controlled forestry operations in Greece as well as in Hungary. In the latter country, the quality of the yield has been considerably increased, the proportion of construction timber from State forests having risen from the prewar 18 percent to 32 percent in 1947/48. In Denmark, the sale of sawlogs from national forests is limited to concerns which have obtained official authorization and are willing to submit to regulation by the government.

The scarcity of mineral fuels is still apparently the reason why in many countries wood is being used for fuel, although it could be used to better purpose by industry.

Generally speaking, research is directed towards more complete utilization of waste products and of hardwood species for many purposes.

Government forest services. Many national forest services have been or are being reorganized to enable them to cope with the vast tasks which they must accomplish.

Some of these reorganizations are concerned with a greater emphasis on the control of private forests; as for example, the creation of the Office for the Protection of Forests in Norway; others are for the purpose of implementing the new reforestation plans which have been formulated: this applies to the reorganization of the Reforestation Service of Czechoslovakia and the expansion of the Forestry Commission of the United Kingdom. German forest services are being re-established. In addition, there is a tendency in Hungary and Czechoslovakia to entrust special agencies with technical functions, such as logging operations.

However, generally speaking, the reports submitted do not give a sufficiently clear picture either of trends toward the extension of powers entrusted to the forest services, or of the nature of the liaison between these agencies and the agencies directing the economic policies of each country.

Manpower. Finally, there is a marked trend everywhere to study the questions of manpower, particularly in the Northern countries where it is scarce. The problems of output on the job, of training of personnel, of providing living quarters for forest workers, etc., are mentioned in several reports.

Subcommission on Mediterranean Problems

THE Subcommission on Mediterranean Problems held its first meeting at the European Regional Office of FAO in Rome from 13 to 17 December 1948.

The meeting was opened by Antonio Segni, Italian Minister of Agriculture and Forestry. The following countries were represented at this conference: France (Metropolitan France, Algeria, Tunisia, Morocco), Italy, Greece, and the United Kingdom (Cyprus). Yugoslavia and Israel sent observers.

Professor Aldo Pavari, Director of the Forestry Research Station at Florence, was unanimously elected Chairman. Jean Paul Challot, Conservator of Forests in Morocco, was nominated Vice-Chairman and R. R. Waterer, Conservator of Forests in Cyprus, and Christos Moulopoulos, Professor of Silviculture at the Salonika University, were named rapporteurs.

The Subcommission decided to concentrate on the following:

(1) importance of the land-use problem and recommendations for securing international co-operation;

(2) definition of geographical regions to be included in the Subcommission's studies;

(3) technical problems, principally (a) species and types of trees to be introduced, (b) measures against fires, plant diseases, and insects, and (c) reforestation and soil conservation techniques.

After the Subcommission had discussed the general principles to be followed in the three fields, it referred these questions to three working groups for more detailed study and for the drafting of appropriate recommendations.

The Subcommission heard a paper read by Professor Giordano on the better use of forestry products in the Mediterranean Region and requested him to present a formal proposal for its consideration.

The Subcommission adopted the following reports of the working groups and the resolutions on better use of forest products.

Report of Working Group I

Land-Use Problem

The destruction of forest growth in the Mediterranean region has been followed by rapid deterioration of the soil and disturbance of normal moisture relationships. These conditions are particularly alarming in countries where population is increasing.

Despite certain variations due to local conditions, the forests in the Mediterranean countries play several important roles common throughout the area. Among these the Subcommission considers two as outstanding: first, protecting the soil and regulating stream flow; and second, providing local populations with timber, fuel, and other forest products. The relative importance of these two roles varies, but soil protection is of primary importance in most areas.

The bad state of existing forests is due in large measure to unrestricted grazing, particularly by goats and sheep. The Subcommission recognizes that this condition raises the whole problem of a fundamental change in the way of life of large sections of the populations. Remedial measures can only be effected through intimate co-ordination of all governmental and communal authorities connected with forestry, agriculture, pasturage, water engineering, and social welfare. Combined planning is essential, and forest improvement and reforestation, as the first step in soil restoration and conservation, must start in small demonstration areas. The success of these experiments should encourage further expansion over larger areas.

Two fundamental requirements must be met if the problem of rehabilitation of Mediterranean forests is to be approached with any hope of successful solution. First, adequate finances must be available throughout the rehabilitation period; and second, there must be social and economic stability. Forestry measures must be long-term measures, and it is obviously futile to embark on a program at a time when upheavals beyond the control of the authorities concerned might stop the work before completion and destroy the whole effort.

It is essential for governments to formulate and declare their forest and pasturage policies to ensure continuity of land use and to enable effective application of such policies by the executive officers.

The Subcommission believes that the inauguration of one or more demonstration projects in the improvement of land use from unrestricted pasturage to an integrated economy, paying due attention to the role of forests and tree crops and to soil restoration and conservation generally, would be a valuable project for concerted international action under the auspices of FAO. The capital investment required for the rehabilitation of selected areas would not be large. The main portion could be included in the budgets of the participating countries. The Subcommission is of the opinion that such demonstration projects would fall within the categories of undertakings for which the International Bank for Reconstruction and Development grants loans to cover part of the capital investment.

The Subcommission therefore recommends that FAO

(1) explore with interested governments the possibility of selecting mutually satisfactory areas for demonstration;

(2) obtain the agreement of such countries to provide financial, legislative, and administrative support as required, including arrangements for investigation and research by agencies interested in any land-use problems arising in such areas; and

(3) approach the appropriate international authority to secure such additional funds as may be required to complete the financing of such projects.

Working Group II

Delimitation of Mediterranean Area

The Subcommission proposed that, instead of defining the Mediterranean countries, the regions over which the action of the Subcommission is to extend be delimited.

It appeared advisable to list the countries interested in the problem through either all or part of their territory: Portugal, Spain, France, Italy, Switzerland, Yugoslavia, Albania, Greece, Bulgaria, Turkey, Syria, Lebanon, Palestine, Egypt, Libya, Tunisia, Algeria, Morocco, and the Mediterranean Islands.

Countries having similar ecological conditions, such as the United States (California), U.S.S.R. (South Crimea), South Africa, and Australia, were added to the list.

The Subcommission considered it necessary to give a definition of Mediterranean countries. It seemed that two regions ought to be delimited: (a) the Mediterranean area proper, and (b) the transitional regions.

The Subcommission proposed the following methods to differentiate the subdivisions of the two aforesaid groups: (a) a working method based on climatic factors; (b) a working method based on biological factors; and (c) an ecological method combining all environmental factors.

The method which should give the best results is the one based on the aggregate ecological factors.

This synthesis may be set forth by superimposing simple cards on an outline map, each card representing one of the important factors of the environment.

The main characteristics of the method are indicated in the report of Mr. Gaussen.

This cartography gives the synthesis of the environmental conditions by color, and the mode of placing the color represents the present plant cover as it has been modified by man. This present condition is only one of the economic possibilities of the environment, the only permanent element independent of man.

The Subcommission called the attention of the FAO divisions engaged in agricultural and pastoral economy and soil conservation to the importance of drafting a map which would illustrate statistical data of all kinds and which could be based on the 1/1,000,000 international map, without excluding other scales.

This map would clearly show the results of a general enquiry on the present plant resources of the world and the possibilities of changing this present state.

This ecological work would show the regions of the world where the environment is biologically analogous, and this would provide scientific bases for testing exotic plant species of economic importance.

The making of a world map, therefore, would appear to be particularly fruitful. It would also permit a more precise knowledge of the field of action of the Subcommission in Mediterranean countries and in other parts of the world.

Working Group III

Technical Measures

Fire Control. After hearing the reports on forest fires, the Subcommission requested that forest services and institutes for forestry research turn their attention to the early study of: (a) broadleaved species capable of acting as a check to the spread of fire in forests; (b) the possibility of establishing groves of fruit trees in order to interest the local inhabitants in the importance of taking part in fire control; and (c) appropriate means of educating the public in order to limit the damage done by campers and tourists.

The Subcommission requests the forest services of the countries concerned to exchange through the intermediary of the secretariat all documentation on present means of forest fire detection and control.

Study on Varieties. The Subcommission

(1) recommended that the competent authorities of all countries concerned set up a forest seed testing service;

(2) recommended that the forest services of the different Mediterranean countries send to the corresponding forestry research institutes identification cards on all stands of forest species which seem to be exceptional types, either because of particular characteristics or because of unusual ecological conditions; and that the forest services adopt as an example the *Libro Nazionale dei Boschi da Seme* kept by the Forestry Experiment Station and the Institute of Silviculture of the University of Florence, Italy, in agreement with FAO;

(3) recommended that the forest research institutes of these countries include in their program a more thorough investigation of these types, their propagation by grafting or cuttings, particularly in regard to the poplar, and the creation of new types by hybridization; and that they interchange — within the plan of the International Union of Forest Research Institutes and the International Poplar Commission — the documentation which each will have centralized, as well as specimens of types of possible interest elsewhere;

(4) requested the governments concerned to consider the possibility of granting to their forest research institutes the funds required for carrying out these investigations.

Plant Diseases. After hearing reports on the spread of plant diseases and particularly on the present development in chestnut groves of *Endothia parasitica* which constitutes a very serious danger to the world, the Subcommission passed a resolution that the countries concerned make investigations and report to the secretariat all localities in regions formerly free from attack, where the disease appears, and that in the contaminated zones, the specimens which seem to be resistant to attack be located and studied.

It also requested FAO to encourage and support the research work undertaken on this disease by the Italian Government and to sponsor the establishment of a National Chestnut Center, in liaison with the proposed International Chestnut Commission which was endorsed by the Fourth Session of the FAO Conference.

It further requested FAO to assist in reinforcing and unifying frontier plant pathology services within the general measures already advocated for preventing and checking the spread of plant diseases.

Reforestation and Soil Restoration. Having heard an exchange of views on the technical problems of reforestation and soil restoration, and realizing that it was impossible to enter into a detailed comparison of the different methods employed, the Subcommission

(1) recommended that governments instruct their technical services and forest research institutes (a) to carry out investigations on the control of surface erosion and gully erosion and to consider reforestation not as a purely economic problem but as a means of soil and water conservation; (b) to limit reforestation proper to purely forest land and to apply to land suitable for other uses soil restoration practices based on the same principle of protecting slopes and regulating stream flow; (c) before beginning reforestation work, to study the ecological conditions of the site, the possibilities of regeneration of the forests to be established, and the construction of a network of logging roads to permit future exploitation;

(2) pointed out that, in view of the progressive increase in population in Mediterranean countries, soil conservation and restoration are of special importance. It therefore recommended that governments allocate to their forest services sufficient funds for the rapid extension of their investigations and the necessary execution of their projects.

Motion on Better Utilization of Forest Products

The Subcommission calls the attention of all the Mediterranean countries to the necessity of carrying out systematic investigations into the technological aspects of wood increment or other production, whether in new plantations or in natural forests about which little as yet is known; and recommends that FAO provide effective support in order that the results obtained in the most important cases may be assembled, studied, and made known to all countries.

Among the technological problems to be studied, the Subcommission mentioned: (a) the practice of tapping the Mediterranean pines and its effect on the characteristics of the wood, timber output, seed production, etc.; (b) the possible uses of eucalyptus wood; (c) the characteristics of the wood of central European or exotic conifers cultivated in the Mediterranean regions; and (d) improvement of cork production.

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of Unasylva. *They are grouped alphabetically by countries under headings currently used by the Division of Forestry and Forest Products for reference purposes. The Editor will be glad to receive direct from readers authenticated items of interest and of news value for this part of the review.*

General

Czechoslovakia

● Forest research organization is divided among 12 so-called "institutes." The staffs of these institutes consist of a leader and one or two associate specialists. There are 43 persons engaged in forest experimental work in the entire Bohemian territory; of these, 21 are specialists with higher education. What they lack in numbers, however, they make up in quality. The leaders for the most part are highly qualified scientists of international reputation, motivated in their work by ideals of public service. Until 1938 forest and agricultural experimental work, as well as the supervision over the middle and lower forest schools, was handled administratively in one unit of the Ministry of Agriculture. Under present organization the administration of the forest schools was transferred to the Ministry of Education. Forest research, although it still remains in the Ministry of Agriculture, is entirely separated from agricultural experimental work, forming an independent administrative unit there.

In Slovakia, which enjoys autonomy, the forest institutes, although working in close co operation with all other forest institutes, are directly under the jurisdiction of the Slovak representative of agriculture and land reform in Bratislava; only forest matters affecting the whole republic are referred to the Ministry of Agriculture in Prague.

The enumeration of the forest institutes, their location, and their official designations give some idea of the character of the work they do.

Forest Institutes in Prague (Bohemia)

The Institute for Biochemistry and Pedology is concerned with studies of forest soils, nutritive demands of forest trees, use of fertilizers in forest nurseries, improvement of degraded soil, and similar problems.

The Institute for the Protection of Forests studies pests and diseases attacking wood and living forest trees.

The Institute for Huntsmanship protects and propagates game birds and wildlife as a source of state revenue through hunting privileges.

The Institute for Forest Policy and Administration confines itself to training forestry workers in the use of improved tools and their care as a means of increasing the productivity of labor and the standard of living of the workers.

The Institute for Forest Exploitation and Wood Technology studies improved methods of sawing timber, impregnating wood with antiseptics, drying, and care of tanning bark, preparation and drying of chunks of wood for use in wood-gas generators, and so forth.

The Institute for Forest Engineering, Transport, Melioration, and Torrent Control has as its main task the study of various types of forest roads and equipment for the most economic transport of forest products. It also studies the forest as a regulator of waters.

The Institute of Forest Dendrology and Geobotany studies the morphological and physiological variability of tree species, past changes in regional forest floras, and selection of new varieties.

Moravia

At Brno in Moravia there are three more forest institutes:

The Institute of Silviculture and Forest Biology. Forest planting, test of species not native to the country and selection and propagation of more desirable tree varieties are the projects that receive most attention.

The Institute for Forest Economy studies forest mensuration. Its main task, which will take several years to complete, is the preparation of volume and growth tables for the Bohemian pine forests. At the same time it is testing the applicability of Schwappach's growth tables to spruce, fir, pine, oak, and beech under Czech conditions.

There is also a research station for forest geodesy and air photography.

Slovakia

Slovakia has two forest institutes located at Banska Stiavnica; they are similar to those in Brno and Prague: the Institute of Forest Exploitation and Wood Technology, and the Institute of Silviculture and Forest Biology.

Dissemination of the results by publication of technical papers, by radio, and by lectures constitutes an important activity of the forest research organization. A popular magazine, "Lesnicki praci," is published by an organization for the promotion of forestry in the City of Pisek in Bohemia. Recently the Ministry of Agriculture authorized the publication of an annual symposium on the work of the forest research institutes. The first volume covers the work for 1947.

UNITED KINGDOM

• Educational Publicity Limited of London has begun the issue of several series of film strips on the subject of timber and forests. The first film is called "The Story of Timber" and includes 26 photographs showing methods of felling, extracting, transporting, and storing of timber and the manner in which it is sawn, cut into veneer strips, stacked, seasoned, and transformed into construction material. The second, "The Growth and Structure of Wood," shows the functions of the various parts of the tree and the structure of the various parts of the tree stem. Others deal with the utilization of timber, plywood manufacture, and the identification of timbers, and preservation; further films are in preparation. Each series of film strips is accompanied by clear commentary, frame by frame, prepared by the Timber Development Association which collaborates in the making of these films. Some of these films merit the attention of schools for training foresters or wood technicians, while others are well suited for use in public education courses.

• The following publications, Timber Information Leaflet No. 36 *Introduction to Sawmilling;* No. 37 *Siamese Timbers;* Timber Development Association Design Sheet No. 1 *Roof Type "A,"* and Constructional Research Bulletin No. 1 *Timber Connectors,* have been issued in accordance with the policy of United Kingdom Timber Development Association Limited to give every assistance to industries concerned with the use of timber. As far as possible they are issued free of charge to organizations engaged in works for the reconstruction of British industry and the provision of essential services such as housing and education. One of the aims of this circulation is to establish means whereby particular requirements of different timber consuming industries can be clearly defined and met.

UNITED STATES OF AMERICA

• A code of ethics for the forestry profession has been adopted by the Society of American Foresters. The code was developed by a special committee of the Society which made a study of the ethical practices of older professional groups. The newly adopted canons will be broadly construed in the interest of the public welfare and professional advancement. They are now deemed to be the duties, obligations, and responsibilities of the technical forester to all those with whom he comes into contact in the course of his professional work and life.

Fundamental Science

AUSTRALIA

• Bulletin No. 34, *Carbohydrate Absorption by Roots of Pinus taeda,* issued by the Department of Agriculture and Stock, Brisbane, Australia, gives the results of experiments which demonstrate the role of organic matter in pine nutrition. Seedlings of *Pinus taeda* were used as test plants. It showed that the seedlings can exist and grow in carbondioxide-free atmosphere, and that the fungus *Boletus granulatus* is capable of providing pine roots with a carbohydrate supply derived from cellulose and suitable for pine nutrition. Maltose supplied in solution also supports growth much longer than sugar-free media, but not for so long and not so well as that provided by mycotrophic means. It was also shown that mycorrhizas, with the aid of organic matter, are able to supply carbohydrate to the plants by means of the roots, and that this supply can be at least accessory to that supplied by photosynthetic activities.

CANADA

• A bulletin entitled *The Trees of Quebec—a Simple Method of Identification,* by L. Z. Rousseau, recently published by the Forest Service of the Province of Quebec, has abundant illustrations and constitutes a valuable guide for the rapid recognition of the trees of the Province. Following a definition of the terms used in the description of the characteristic parts of the trees, it gives a key to the identification of local tree species both in winter and summer which would enable even the beginner to recognize them.

CZECHOSLOVAKIA

• Dr. Bonuslav Maran of the Research Institute for Biochemistry and Pedology at Prague has carried on studies of soil moisture in several forests on soils ranging from brown earth to typical podzols, at different depths, and under very humid and semi-arid conditions. The observations were made on spruce and fir undergrowth in pine, birch, and oak forests; of beech, oak, and hornbeam undergrowth in forests of pine and larch, and also of oak. Although no final conclusions can be drawn from these observations as to whether undergrowth dries out the forest soil or on the contrary increases the soil moisture, some generalizations are more or less definitely indicated.

1. Pure even-aged spruce forests in a warm, dry climate have for almost the entire vegetative period the lowest soil moisture content.

2. The highest average soil moisture for the year has been found mostly under coniferous and deciduous stands of light-demanding species having no undergrowth.

3. In most cases the soil moisture was higher in stands that had undergrowth than in stands without undergrowth. Deciduous undergrowth in this respect had a decidedly more favorable effect than coniferous undergrowth. A dense undergrowth of fir had the worst effect.

4. Pine forests with an undergrowth of spruce in a humid climate had more moisture in the soil than a similar stand without undergrowth.

5. The greatest soil porosity was found in stands with all kinds of undergrowth. The least porosity was found in an even-aged spruce pole stand.

6. The soil moisture varied considerably at the different seasons of the year. In general, however, during winter and spring the soil moisture was highest in stands without undergrowth, but in summer the highest moisture was found in both deciduous and coniferous stands of light-demanding species with undergrowth, irrespective of whether this undergrowth was deciduous or coniferous.

7. During critical periods when the minimal amounts of moisture in the soil

have a deciding influence, especially important in warm, dry climates, the presence of undergrowth in a forest has a favorable effect.

8. Deciduous undergrowth exerted a more favorable influence than coniferous undergrowth, not only on the physical properties of the soil, namely its water-retentive capacity, but also on its chemical properties.

Silviculture and Management

Belgian Congo

• In 1945 planting experiments were conducted in the Belgian Congo using seeds of ten species of eucalyptus. Only the *Eucalyptus grandis* which was originally obtained from New South Wales and Queensland produced worthwhile results. Two plots were established, one at an altitude of 1,750 meters and the other at an altitude of 2,050 meters. In 34 months, trees on the first plot attained an average height of more than ten meters with an average circumference of 34.5 cm., while on the second, trees attained an average height of 9.43 meters with an average circumference of 29.8 cm. On the first plot, a volume per hectare of 68 m^3 has already been attained. This species has thick foliage and throws a dense shadow which effectively protects the soil. The thick layer of dead leaves which it deposits conserves soil humidity well. Finally, the wood—at least in the country of origin—is of high quality. It is therefore apparent that this species should be of great value for reforestation purposes in the high altitudes of the Kivu, the Ruanda-Urundi and probably of the Katanga regions.

Canada

• A considerable time has now passed since the early reforestation work was carried out in Canada, and the results obtained with the many different species used are of interest. In the prairie provinces of Alberta, Saskatchewan and Manitoba, more than 200 million young trees have been distributed to farmers over the past 40 years and the Dominion Forest Service has been able to maintain records of the successes achieved. It is interesting that the species which showed the least success were *Pinus strobus* and *Pseudotsuga taxifolia*. Amongst the conifers, the Siberian larch, *Larix sibirica*, was outstanding in rate of growth and usefulness. White spruce, *Picea glauca*, and Colorado spruce, *Picea pungens*, were very successful for shelterbelts. Scots pine showed good growth but has bad form, the same experience having been met with in British Columbia. Amongst broadleaved species, certain poplars showed the best results, together with species of ash, alder, and maple.

China

• The common method of producing a sustained supply of fuelwood is exemplified by the following. Twenty years ago the villagers of a hill area about 24 km. (15 miles) southwest of Nanking started a forestry co-operative in order to supplement their income by growing trees for fuel. At present five villages belong to this co-operative and derive a large part of their income through the sale of fuelwood from over 400 ha. (1,000 acres) of pine trees that they have planted and are managing on a sustained production basis. In the spring of the year after the tree has attained an age of five years, the tree is cut leaving one or two lateral branches to continue growth. Every two years thereafter, similar growth is removed. The material thus obtained is sold for fuel to nearby lime kilns and the markets at Nanking, in exchange for cash to buy food and clothing. Each tree produces over 9 kgs. (20 pounds) of fuel every two years. In the autumn the villagers cut the grass growing between the trees for local consumption as fuel and as hay for their work animals. Besides reducing the fire hazard, the removal of the grass exposes the trees to better growing conditions.

Union of South Africa

• A South African geographer, Mr. T. W. Gevers, recently analyzed the effects of bad soil utilization in the Great Escarpment region in the northeastern part of the Transvaal. This mountain chain is of paramount importance in relation to the streams which water the dry regions in the east and the west. However, since 1926, flow of the rivers which have their sources in these mountains has gradually declined. The destruction of the vegetative cover and the advance of erosion are attributed to the increase in the number of farmers and the overpopulation of native reservations. It has been pointed out that the introduction of the eucalyptus would perhaps further intensify this phenomenon. The role played by this exotic tree species has been the subject of many controversies. "There is no need for complicated research," this author writes, "when we observe that of two comparable tributaries draining the two opposite sides of a low narrow mountain ridge, the one whose watershed is covered with a dense plantation of eucalyptus has completely dried out, while the other, which has retained its original cover of thickets, brushwood and grass is still active."

United States of America

• In the northwestern section of the State of Montana alone, Christmas tree cutting brings in approximately one million dollars annually. The growth of this industry, which prolongs the employment season of a large number of lumbermen, has led the Northern Rocky Mountain Experiment Station to investigate the possibility of managing this harvest on a scientific basis and to study the proper silvicultural methods. Valuable information has already been obtained concerning certain types of cultural operations applicable to young trees, such as pruning, thinning and "stump culture," which consists of growing a new crown from the lower branches of the trees, or from an adventitious bud after removal of the upper portion of the crown.

• For the past two years a large pulp and paper firm on the west coast has been developing a widespread reforestation program which is now near completion; it covers 4,000 hectares (10,000 acres) in the states of Oregon and Washington. Seeding and planting are both used. Amongst the trees planted are 50,000 one year-old Monterey pines, *Pinus radiata*, produced at a forest nursery in the State of Washington from New Zealand seed. It is well known that this species, native to a small area of California, where it was only a secondary species, has given astonishing results when introduced to New Zealand. The present experiment is, therefore, of great interest.

Seeding was mostly done by helicopter. The use of helicopters and planes for seeding is extending in U.S.A. In the State of Minnesota, seeding from aeroplanes was tried last year on 490 hectares (1,200 acres) of land burned over in two consecutive fires. A recent survey shows abundant regeneration, but a further check will be made when the trees are two years old to gain more precise information.

• The October 1947 fires which occurred in the southwestern portion of the State of Maine burned over 53,000 hectares (130,000 acres) of forestland including 19,400 hectares (48,000 acres) of marketable wood, principally white pine, *Pinus strobus*. Salvage operations were begun in the winter of 1947/48 and the immediate task was to determine which damaged trees could be left standing without incurring the risk of having them decay in a few years time; how natural forces will act to reconstitute these stands and what influence can be exerted to obtain forests containing the greatest possible proportion of pine species. Studies have been conducted by the Northeastern Forest Experiment Station. By July 1948 the probable composition of the future stands seemed clear for the greater part of the burned over areas. Wherever the fire had been intense, all that is seen now are shoots and seedlings of grey birch, red maple and oak. Where it was less severe, there was good regeneration of pine and hemlock, *Tsuga canadensis*. The year 1947 was a good seed year for these two species. However, the hemlock cones had not opened when the fire occurred, while the pine had already shed most of its seed. There is every indication therefore that hardwood regeneration will be favored to a large extent, and that it will be necessary to undertake plantings, followed by careful weedings, in order to ensure the restocking of the growing stands with softwoods. The survey recommends that non-damaged coniferous seed trees should be retained or at least the felling of seriously damaged trees which still appear able to produce seeds for one or two seasons, should be delayed. As a guide to these operations the compiling of maps is proposed, showing on the one hand the volume per unit area and on the other the degree of damage caused by the fire to the humus layers and the organic ground cover and, finally, the nature of the site. Trees suffered particularly from ground fires wherever the humus layer and organic debris were burnt to considerable depths. The danger of windfalls is particularly great in wet areas or swamps. Such maps would enable land owners or logging operators to determine approximately the extent of the danger which they would incur by delaying salvage operations in the damaged stands.

• Among the experiments conducted at the Institute of Forest Genetics at Placerville (California), those which appear to have the greatest future for the pro-

duction of fast growing timber involve the hybridization of the white pine.

It has been possible to obtain a hybrid by crossing the western white pine, *Pinus monticola*, and the eastern white pine, *Pinus strobus*, which at four and one-half years of age is twice as tall and three times as heavy as either parent tree at the same age. Further experiments are now being conducted on selected plantations. Work initiated at the Royal Botanical Gardens of Denmark is being followed up with a view to discovering a white pine hybrid resistant to blister rust, *Cronartium ribicola*, which attacks almost all five-leaved pines. Denmark has sent pollen to Placerville from resistant hybrids, as well as pollen from the white pine of the Balkans used in its own experiments.

• In the United States site classification is generally based on the height of the average dominant type species in a 50-year-old stand. However, a marked trend in forestry research has been noted in this country to seek a correlation between these site indices and other factors which have the advantage of being determinable by pedological means, especially before the stands have attained this age.

An experiment of this type was recently conducted in aspen stands, *Populus tremuloides* and *P. grandidentata*, which cover approximately 8 million ha. (20 million acres) in the Lake States and the management of which raises many problems.

It has been possible with respect to these stands to distinguish five site indices, based on the texture of the soil in the A and B horizons, and presence or absence of lime in the subsoil. Class I, for example, is characterized by a silt plus clay content of more than 35 percent, but less than 20 percent of clay and a slightly calcareous reaction. Class V has an average content of less than 10 percent, with an acid reaction.

Among other indicators for site-index prediction for aspen, the following may be mentioned: the former cover before the aspen is introduced, this being nearly always brought about after fire has wiped out the original stand; the nature and abundance of the ground vegetation covering the site; finally, the type and abundance of the seedlings of other species which install themselves under the cover of the aspen during the process of reconstitution of the original forest.

Mensuration, Increment, and Yield

INDIA

• *General Standard and Commercial Volume Tables for Terminalia tomentosa* is one of the new series of the Indian Forest Records. The work was started in 1935; the tables compiled in 1942; but publication was held up until 1947 on account of the war. The tables for standard timber were based on 723 single tree measurements, while those for commercial timber were based on 317 single tree measurements. Although these volume tables have been considered incomplete, due to scanty data used especially for the upper and lower diameter classes, they present interesting information that will be useful locally for the silvicultural treatment of *Terminalia tomentosa*.

Forest Protection

CANADA

• Experts of the Entomological Laboratory at Sault Ste. Marie (Canada) will study in 1949 the long-term effects of DDT which was sprayed over thousands of hectares in 1945 to combat spruce budworm, *Cacoecia fumiferana*, infestation. The effects of the DDT on the pest were completely satisfactory, but it is most important to study its possible harmful effects on other insects and forms of life. For instance, in some cases, a high mortality rate amongst fish resulted, not directly from the effects of the DDT, but because their normal sources of food had been all but eliminated.

• The Province of Quebec has opened a school for the training of specialists in forest fire protection at Duchesney, approximately 60 kilometers (37 miles) from Quebec City, where there is already an important ranger school.

The school receives graduates from the ranger school and the teaching staff consists of 6 professors and 2 instructors. Subjects taught relate to the system of protection in force for the Province's forests, how forest fires spread, prevention, law, organization, fire spotting, fire fighting, meteorology, forest entomology and other basic work. Practical work covers the installation of watch towers; the laying, maintenance and operation of telephone lines; installation and operation of radios; use and maintenance of tools and fire-fighting equipment; counter-firing, fire fighting, preparation of plans and the organization of fire protection, and the drafting of reports. Twenty candidates are admitted to the school each year. Refresher courses for existing staff will also be given.

• Quebec Forest Service Bulletin No. 12 calls attention to the extent of losses in the Province of Quebec caused by various fungi which lead to the decay of the heartwood of fir trees. It includes a brief description of the various types of blight and indicates means of combating them. The means consist essentially in the maintenance of the stands in healthy conditions and the lowering of the felling age to about 80 years of age, a maximum beyond which losses due to decay may attain considerable proportions.

• The Department of Lands and Forests of Ontario, in Technical Circular No. 167, publishes the results of the experiments it conducted in inducing artificial precipitation by the sprinkling of clouds with dry ice. The results do not yet enable any definitive conclusions to be drawn. However, it seems that the only clouds which lend themselves to the type of operation envisaged consist of water droplets which are below the freezing point, but have not yet become crystallized. Such clouds can be identified by the temperature of the air, the formation of ice on the aircraft passing through them, the presence of a halo surrounding the shadow of the aircraft and by the peculiar appearance of the sun viewed through these clouds. In order for the dry ice inoculation to produce any appreciable effect, the cloud must be at least 1,200 meters (4,000 ft.) thick and its base must be at least 1,500 meters (5,000 ft.) above ground level. The dry ice used must be crushed into pellets approximately 10 mm. (⅜ inch) in diameter. Seeding should preferably be done from above the cloud. The aircraft should have equipment to control the distribution of the dry ice.

FRANCE

• Encouraged by the achievements in America and Switzerland in combating *Scolytidae* attacks on elms by using powdered DDT in solution in petroleum derivatives and heavy oils, experiments are now being conducted in France, Switzerland, Germany and elsewhere to discover an effective weapon against the *Bostrychidae* attacking spruce, fir and pine which are now ravaging the forests of Central and Western Europe. Insecticides with a Hexachlorocyclohexane base have proved effective. Unfortunately, this treatment, which is easily applicable to felled trees and eliminates the necessity for barking, and which consequently makes possible the large-scale use of the tree-trap technique, is difficult of application to standing trees due to their height and the need to apply the product around the entire tree trunk. The use of high-power machinery mounted on trucks or tractors might solve the problem on level areas but not, of course, in mountain regions or on steep hillsides. Despite the value of these experiments, the best protective methods still consist in following proper silvicultural and felling practices, the removal of decaying trees from stands and removal from the felling sites of felled trees which have not been debarked or have become infested, instead of allowing them to lie around on the ground indefinitely.

Logging and Engineering

FRANCE

• French forestry services are at present investigating the possibility of using helicopters for the loading, transportation and unloading of timber. A machine has been designed especially for the transportation of heavy loads and could be used for the exploitation of tropical forests. Helicopters using jet propulsion can lift logs weighing up to eight metric tons. They are simple in structure and strong and require only a small amount of maintenance. The load is lifted as

follows. Once the slings are adjusted around the logs, the helicopter rises slightly to draw the cable taut. Then the pilot accelerates while gradually reducing the angle of incidence of the rotor blades. In this way the blades can be made to attain their maximum speed without raising the helicopter. Once this speed is attained, the pitch of the blades is gradually increased, producing sufficient force for lifting the load and transporting it. This method had already been used experimentally in Germany. Experiments indicate that jet propulsion helicopters could be adapted to the transportation of logs in equatorial regions, and thereby reduce by 80 percent the labor force used in forest enterprises. The helicopter could also be used for inventories, loading and unloading equipment shipped to coastal areas which had no port facilities, forest fire fighting, for spraying insecticides, etc. There still remains the major question of the cost of utilization. This has been studied very thoroughly, and calculations show that the cost of transportation by this means is less than the freight rates per ton for moving the logs by caterpillars, narrow gauge railway lines or by truck for a distance of 35 kilometers.

Conversion

Australia

• A bulletin issued by the Division of Forest Products, Council for Scientific and Industrial Research, shows that a survey of possible methods of extracting native lignin from immature *Eucalyptus regnans* led to the conclusion that one of the most promising solvents was methanol. Treatment with this solvent for 24 hours at 150°C. removed a little more than one-quarter of the lignin, estimated as Klason lignin, present in a specimen of *E. regnans* sapwood sawdust. Treatment for 148 hours, using fresh methanol every sixteen hours, removed about 70 percent of the original lignin estimated as Klason lignin. Evidence was obtained to show that the methanol extraction of wood is essentially a mild acid hydrolysis accompanied by the solvent action of methanol. During the process some of the extracted lignin was degraded to materials soluble in water and ether. The remainder could be precipitated as a buff powder which gave the color reactions of native lignin and which was soluble in bisulphite solutions.

United States of America

• In the State of Washington, employment in sawmills and shingle mills has dropped 52 percent in twenty years, owing to the rapid exhaustion of the virgin timber stands on which these industries grew up. But employment has increased 57 percent in those industries which practice a closer utilization of the forest crop, such as pulp mills and plywood plants. The State Forest Products Commission has recommended that the Forest Products Institute should make an inventory of all unused sources of raw material, whether in the forest or in the mills. This should reveal the quantities and kind of unused waste which could be used for new industries and also where such industries could best be sited. It will also constitute the basis for a real plan of integration aimed at the maximum utilization of the State's forest resources.

Utilization

Canada

• A whole new industry and, in Canada, a very important one, has developed from the use of waste sulphite liquor for the manufacture of ethyl alcohol. The process is not new, having been in use commercially in Scandinavia as well as the U. S. and Canada for some time.

The world's largest plant of this kind is now in operation near the Canadian International Paper Co. pulp mill on the Gatineau River in Quebec, north of Ottawa, when Commercial Alcohols, Ltd., officially opened a specially designed $3,000,000 plant which is expected to produce 9.1 million liters (2 million Imperial gallons) annually. Previously, the largest plant of this type was that of the Puget Sound Pulp & Timber Co., at Bellingham, Washington, built in 1945, with a capacity of 5.7 million liters (1.5 million U. S. gallons) annually.

The mill, from which the plant draws its raw materials, turns out approximately 730 metric tons (800 tons) of newsprint and 150 m. tons (160 tons) of dissolving pulp daily. Commercial Alcohols, Ltd., will handle about 3.2 million liters (700,000 Imperial gallons) daily of sulphite waste liquor from the mill.

The paper company has 16,000 km^2 (6,000 sq. mi.) of Crown timber limits tributary to the Gatineau River and an excellent record of steady operation ever since its completion in August 1927. These timber resources should assure the paper mill of a continuous supply of wood for making pulp and paper, and the alcohol company an excellent source of supply of the waste liquor for making alcohol. About 4.5 liters (one Imperial gallon) of ethyl alcohol can be made from the sugars in every 450 liters (100 Imperial gallons) of the sulphite liquor.

A new magnesia insulation factory now under construction nearby will use the carbon dioxide formed as a byproduct in the fermentation process. At capacity, about 25 tons of carbon dioxide will be produced daily and piped to the insulation plant, a completely mechanized unit. This process was perfected only recently, after years of study by the Johns-Mansville Corp. Magnesia insulation output will be sold under contract to the Canadian Johns-Mansville Corporation.

India

• Twenty-eight timbers which deserve attention from users are described in *Some More Commercial Timbers of India*, (Indian Forest Records (New Series) Utilization Vol. 4, No. 3). None of these timbers were much used before the last war. The object of the publication is to bring to the notice of industries further natural resources of India which might be made use of in the future, and to induce forest officers to grow these trees to increase timber supplies.

United Kingdom

• A memorandum has been submitted by the United Kingdom Timber Development Association to the President of the Board of Trade on the subject of the economies of timber substitution. This memorandum states that it would hardly be possible to exaggerate the importance of coal and steel to Britain's industry or to her credit abroad. The relationship of coal, steel and other basic materials to timber is not perhaps obvious, and the T.D.A. wishes to draw attention to certain ideas which are offered as a contribution towards easing difficulties of foreign exchange.

The restrictions placed on the import and use of timber are due to a shortage of foreign exchange rather than to any shortage of world supplies. Although timber is a basic raw material, required in one form or another by almost every branch of British Industry, the present volume of imports is well below the average of all imports in general, calculated in relation to pre-war figures.

The deficiency of United Kingdom timber imports has been met by the exercise of a rigid economy which may be described under three main headings:

(i) the refinement of design and the elimination of wasteful forms of construction;

(ii) the prohibition of the use of timber for non-essential purposes;

(iii) The use of substitute materials.

After nearly a decade of experience in timber economy, it is probable that the limit of development under headings (i) and (ii) has been reached.

The Committee of European Economic Cooperation recognizes that timber substitutes are usually uneconomical. Experience has shown the main disadvantages of the manufactured substitute to be: an increase in production costs leading to increases in the cost of living, demands for higher wages and other symptoms of inflationary pressure; the diversion of manufacturing capacity from export to domestic consumption; the indirect increase of dollar expenditure on substitute materials.

The proposal to regard timber as a substitute for steel, reinforced concrete and aluminum appears at first to be revolutionary. However, conditions in Britain today are not unlike those in which the United States of America found herself after Pearl Harbor. In her efforts to save in steel consumption, the United States used timber for purposes which were novel even in the history of a timber producing country: bridges for the Alaska Highway, floating docks, aircraft and dirigible hangars of unprecedented size, ships and buildings of all kinds—all striking examples which cannot fail to influence trends in years to come.

The increased import of timber will enable the United Kingdom to increase its exports. Timber is one of the cheapest raw materials and is one of the few used in its raw state with the minimum processing, thus releasing manpower and productive capacity engaged in the manufacture of substitute materials.

United States of America

• On 17 September 1948, in co-operation with the Massachusetts Institute of Technology, the Northeastern Wood Utilization Council brought together representatives of pulp mills and others interested for a discussion of the Chemistry and Utilization of Bark. The meeting was held at Cambridge, Mass. The papers and discussion are published in Bulletin No. 25 of the Northeastern Wood Utilization Council, Inc. and summarize present knowledge on bark chemistry and utilization, and suggest some of the further lines of research that are needed. The Council plans to continue

its work with public and private research staffs in promoting these possibilities for bark utilization.

• The first United States plant to utilize waste from pulpwood for the production of yeast has recently commenced operations in Wisconsin. Results from this experimental product may be important to the animal feed industry, and to suppliers of other kinds of yeasts, as well as offering a partial solution to the serious problem of stream pollution. Other pilot plants have been working on cultured yeast grown for human food, which it is hoped can be directed toward relieving the food shortage in many parts of the world.

In other countries, where there is still a marked shortage of proteins, yeast may be more important. During the war, production of food yeast in Germany reached 14,000 m. tons (15,000 tons) a year. A plant in Jamaica has capacity to produce 11 m. tons (12 tons) of dry yeast daily from sugar-mill residue. This plant exports most of its production to Asia. Plans for an experimental food yeast plant in Puerto Rico include direct distribution to local bakers for protein fortification of bread at three to five percent. Other foods generally consumed by the low-income groups in Puerto Rico will also have yeast added.

Another possible growth medium for yeast is the 4 million tons of canning wastes available annually in the United States. A pilot plant to produce yeast from pear waste at the Olympia Canning Company is now supplying material for nutritional experiments at Washington State College. The U. S. Forest Products Laboratory is producing yeast from wood sugars on a small scale for poultry and animal feeding experiments.

Union of Soviet Socialist Republics

• Various intensive methods of tapping Scots pine, *Pinus sylvestris*, were tried in 1945/1946 in western White Russia on trees that were to be cut in one to three years. The highest yields were obtained by a new method in which faces were cut on two levels on each tree, one vertically above the other. These faces were worked alternately. Three refreshings were made at each level before the cup was transferred to the other. Each face rested for nine to ten days between tappings. The seasonal average interval between freshenings was 3.6 days for normal, and 2.3 days for intensive working of the faces at a single level. The combined yield for the two faces exceeded by 66 percent the yield obtained from the ordinary German method.

Economics and Statistics

Bolivia

• The first forestry bulletin published by the Faculty of Agronomical Sciences in Bolivia contains two very interesting articles. The first gives an estimate, based on detailed surveys, of Bolivian resources of coaba, *Swietenia macrophylla*, one of the most sought-after mahoganies. Its importance is increasing because, ever since the discovery of America, the natural stands of *Swietenia mahagoni* have been subjected to intensive exploitation, which has greatly reduced the reserves of this species.

The author indicates the distribution of this mahogany (the Bolivian name of which is mara) in Bolivia and estimates the average density at from 8.2 to 13.6 m^3 (r) per hectare, a figure which is rarely reached in other South American countries within the area in which this species grows. In certain regions there are only 27 adult trees per hectare. The richest zone consists of a triangular area located between the Rio Grande on the East, the Rio Isiboro on the West to their confluence formed by the Rio Mamore, and limited on the south by a line running between the 17th and 17.55 parallel south.

The second article gives interesting information regarding the five-year plan formulated by the Bolivian Development Corporation for the development of the forest resources of the country. In a large measure this plan was based upon data obtained through the research of the author of the preceding article. The implementation of this plan was recently initiated by the erection of a small sawmill having a daily capacity of 19 m^3 (s) (8,000 board ft.) in the Rio Espejo and Rio Piray areas. It should be mentioned that the felling operations in this area are being carried out in private forests, the Corporation having obtained a ten-year license, renewable for an additional ten years, to perform logging operations. This article, although informative as regards the industrial projects planned by the Corporation, supplies no information as to any measures intended to insure the re-stocking of exploited stands. The plan even seems to provide that after the exhaustion of the forest resources in this area the sawmills will simply be removed from their original sites to new areas.

Egypt

• Newsprint is being produced for the first time in Egypt, by a paper mill in Alexandria. Wood pulp is being obtained from Scandinavian sources. The rate of production is currently 25 tons per day which should provide an annual rate of more than 7,000 tons. This figure may be compared with the total annual requirements of Egypt, as imported in 1947, of roughly 9,000 metric tons. Of this, 381 tons were imported from the United States and 901 tons were imported from Canada. The remainder was supplied principally by countries accepting sterling in payment.

Finland

• It was reported in Unasylva, Vol. III, No. 1, page 47, that it had been agreed that the Finnish-Soviet rayon factory Viskoosa Oy.-would be erected in Oulu. Later information indicates that the plans have been rejected, because construction costs are much higher than originally calculated. It is believed that the part of the contributed capital in Russian hands will be used for other purposes, and the project of establishing a joint company has now been abandoned.

New Zealand

• The capacity of a new sulfate-pulp mill now under construction near Tokoroa, New Zealand, will be increased to 23,000 metric tons (25,000 tons) annually from the originally planned capacity of 9,000 metric tons (10,000 tons). This expansion is made possible through further investment in the New Zealand firm by an Australian paper manufacturing company. The mill is expected to be in full production by the end of 1951. Present plans call for full integration; the company eventually will manufacture kraft paper and multiwall sacks, in addition to pulp. Tentative plans for the production of newsprint have been dropped, and it is not likely that the company will enter this field.

Poland

• To assist Poland in regaining her former position as an exporter of timber to the United Kingdom, provision is made in the Anglo-Polish trade agreement signed recently for the purchase over the next five years of a number of Polish timber products. It is hoped that in the year 1949 some 70,000 standards of softwood will be shipped, together with redwood sleepers (50,00 pieces), pitprops (130,000 m^3 (r)), oak staves (300 m^3 (s), plywood (300 m^3) and hardwood (10,000 m^3). A certain quantity of pulpwoods is also expected. To this agreement there is a proviso that import licenses for proportionate quantities of Polish furniture and other timber products shall be granted. Tentative figures for purchases over the years 1950 and 1951 have also been drawn up.

Sweden

• The present technical capacity of the Swedish chemical and mechanical wood pulp industry is said to be about 3.5 million metric tons. Because of the shortage of pulp wood in some areas, however, between one-sixth and one-fifth of this capacity is not likely to be in operation. The total yearly production of pulp is about 2.9 million metric tons, of which some 1.1 million tons are converted into paper by the domestic paper industry. The remainder, about 1.8 million tons, is made available for export. This figure may be subdivided as follows: chemical pulp for paper making, 1,225,000 tons; chemical pulp for industrial purposes, 350,000 tons; mechanical pulp, 250,00 tons.

Cellulose stocks early in 1949 amounted to about 300,000 metric tons, as compared with 170,000 tons at the beginning of 1948 and 241,000 tons in 1947. Sweden's export capacity in 1949 can be estimated at about 1.7 million metric tons.

Swedish cellulose exports to the United States in 1948 totaled about 340,000 metric tons, nearly two-thirds of which were shipped during the first half of the year. In 1947, about 500,000 tons of Swedish cellulose were exported to the United States. Before the war, the U.S. imported nearly one million tons of Swedish cellulose annually.

United States of America

• Record paper consumption in 1948 raised per caput consumption for that year to an estimated 162 kg. (357 lbs.), an increase of 6 kg. (14 lbs.) over 1947, according to the December Statistical Summary of the American Paper & Pulp Association. (February 1949) The Summary states that prospects for the industry in 1949 are related to prospects for general industry, in that the paper indus

try is a "service" industry, the welfare of which is tied in closely with that of general business. A further analysis of the industry's 1949 prospects brings out the fact that inventory building by customers has apparently ceased and that 1949 demand for paper should more closely reflect consumption. Pulpwood, wood pulp and waste paper remain in ample supply. Estimates place total receipts of pulpwood for 1948 at 2.6 million m^3 (r) (one million cords) above 1947. Wood pulp production in 1948 reached a new record high of approximately 11.8 million metric tons (13 million tons). Waste paper receipts for 1948 reached an estimated 6.8 million metric tons (7.5 million tons), a decline of 270,000 metric tons (300,000 short tons) under 1947 because of the tapering-off in demand.

Union of Soviet Socialist Republics

• Uzbekistan is a constituent Republic of the U.S.S.R. in south-central Asia. It is located between the Rivers Amu-Darya and Sir-Darya, occupying the central part of Turkestan. It has an area of some 322,000 km^2, and a population close to 5 million. With a long history of continuous deforestation, now only 6 percent of the country is wooded. Of the natural forests still remaining 89.5 percent are found in the mountains. They lie chiefly in remote tracts where logging is difficult. Their main function is soil and water conservation. Cutting in them, therefore, is restricted to thinnings and cultural improvements. The annual yield from such operations in the mountainous forests is not more than 50,000 m^3 (r). The chief species is called "Archa" (a juniper). The forest growth in the valleys of Sir-Darya, Amu-Darya, Zeravshan, and other rivers consists mainly of poplars, willows, and *Elaeagnus sp.* of the same genus as the Russian olive, which is extensively used in shelterbelt planting in the North American prairies. The trees are poorly formed and are good largely for firewood. The annual yield in timber is estimated at only 700-750 m^3 (r). A 10-meter wide strip along the river banks is kept intact as a safeguard against bank erosion. The desert steppe plant formations consisting of such drought resisting shrubs as tamarix and halozylon are being protected because they prevent the sand from blowing and also because, if properly tended, can yield firewood. Some 20,000 m^3 (r) of tamarisk firewood are obtained annually in this manner. This firewood is taken by camel to settlements within a 12-kilometer radius.

• Incomplete estimates by the government place the damage caused to the forests by the war at more than 3,000 million rubles (about 600 million dollars). Great as this damage is, it is only one half of one percent of the entire loss suffered by the Russian people in the form of cities (1,710), villages (70,000), industrial plants (32,000) destroyed, 65,000 km. of railroads seriously damaged, 109 million head of cattle slaughtered, etc., estimated at about 679 billion rubles, to say nothing of the seven million people killed. The forest destruction in some places assumed a wholesale character, especially in poorly forested Ukraine, in the Baltic Republics, in the region south of Leningrad, and in all accessible forests of Orel, Tula, Smolensk, Kalinen, White Russia, and Karfelia. In the southern semiprairie region, particularly between the Don and Volga, 900,000 hectares of forest plantations and 1,500 hectares of forest nurseries were put to the axe and torch. To combat the partisans, who were hiding in the forests, the enemy cut clean and burned lanes from 200 to 500 meters wide along all railroads and main thoroughfares. The total forest area destroyed in the war is estimated at 20 million hectares.

• Wood is still one of the most used fuels for industrial and especially heating purposes in the U.S.S.R. It constitutes on an average nearly 50 percent of all the wood cut in the entire country. The plan for 1941, for instance, called for cutting 123 million m^3 (r) of firewood for European Russia and about 25 million m^3 (r) for Asiatic Russia. The City of Moscow alone consumes from 3 to 5 million m^3 (r) of firewood a year. To transport such an enormous quantity of firewood places a heavy burden on the railroads. To relieve the railroads from transporting firewood, the government is seeking to devise means for transporting it by water, which of course is also cheaper, and to develop other sources of fuel. It learned during the war that it is practical to float small round timber and firewood in rafts, and a great deal of this material is now reaching the capital in this manner from the Upper Volga by way of the Moscow-Volga Canal. Still even this involves floating firewood to Moscow from a distance of 600 to 900 km. from the forests of Vologda, Leningrad, Gorki, etc. To decrease in general the use of wood for generating power and for heating purposes, the mining of coal, burning slates, and peat is being greatly stepped up as well as the use of natural gas. For instance, even during the war (1943-45), a pipe line 843 km. long was laid to pipe natural gas from Saratov to Moscow. The City of Leningrad obtains a gas supply from the comparatively nearby large slate deposits in Estonia. Kiev, on the other hand, must pipe it in from the Carpathian foothills, a distance of 300 kilometers. It is planned that by 1950 most of the large cities in the Soviet Union will be obtaining a total of 8.5 thousand million m^3 of natural gas, with a 3,000 km. pipe line extension. While the total amount of fuelwood is still very large, its relative place is diminishing. In the 20's, fuelwood constituted 41 percent of all the fuels used; today it is only 20 percent.

• The area of productive forests of U.S.S.R. before the war was estimated (1941) for both European and Asiatic Russia to be close to 500 million hectares, and the annual consumption or cut (including firewood) at a little over 307 million m^3 (r). As a result of the war, new forest areas and possible annual fellings were added. (See next column.)

The forest area of the U.S.S.R. has thus been increased by about 3 percent, and the possible annual cut by 11.3 percent. Against these additions, however, must be placed the devastation of some 20 million hectares of forest in the area of the Soviet Union overrun by the Germans.

Region	Forest area (million hectares)	Annual cut (million m^3 (r
Southern Sakhalin (formerly Japanese-Karafuto)	2.8	[illegible]
Karelia (eastern Finland)	3.0	5.
Latvia	1.7	6.2
Estonia	0.9	2.5
Lithuania	0.9	3.2
Western Ukraine and western White Russia (formerly eastern Polish region)	5.5	10.4
Bessarabia, Bukovina, and Transcarpathian Ukraine	1.3	[illegible]
Total	16.1	[illegible]

• Transcarpathian Ukraine, which became part of the Ukrainian S.S.R. in 1945, has a land area of 1,263,000 hectares, of which 613,000 hectares, or about 50 percent, are under forest.

Annual production is estimated at over 2,000,000 m^3 (r); of this, 30 percent is industrial timber and 70 percent is firewood. The forests are predominantly broadleaf. Beech forms 58.8 percent; silver fir, 25.4 percent; oak, 7.9 percent; spruce, 3.7 percent, and other species, 5.2 percent.

Policy, Legislation and Administration

Algeria

• In Algeria the forest cover which, according to divergent estimates, at one time covered from 7 to 20 million hectares has now been reduced to less than 3 million. Although it is only possible to obtain local figures as to the damage caused by erosion, it is certainly enormous. It is aggravated by the fact that the forest and agricultural zone consist primarily of rugged strips lying parallel to the coast. All plains have already been placed under cultivation, so clearings must be extended further up the sometimes very steep hillsides. Unfortunately, the development of agricultural production reflects the results of the continuous stripping of the soil by wind and water. The average production of cereals has remained at a constant level, but domestic production for local consumption tends to diminish. Livestock is also seriously on the decrease, except for goats, which can accommodate themselves to even the worst terrains. The only progress is in orchard cultivation. The Department of Waters and Forests attempted many years ago to solve the problem of forest protection and reforestation. Since 1885, a reforestation program encompassing 110,000 hectares has been carried out and in 1907 a special reforestation service was created. However, it must be noted that the measures taken have not proved adequate, except perhaps on lands belonging to the State itself. In 1939, several experimental areas were established, one of which—3,300 hectares in size—was in the Oued Barek watershed; it is intended to control cultivation in this area with a view to soil protection, and to reforest only uncultivated lands or wastelands to the extent of 500 hectares. This work was interrupted by the war. A law of 2

February 1941 formulated the following principles as regards soil restoration in Algeria: 1. obligatory erosion control work to be performed at the expense of the State, within the perimeter of the areas declared to be public domain; 2. the imposition upon private landowners of certain conditions or regulations concerning the application of protective measures and the proper management of their plantations; 3. the indemnification of all landowners and rightful claimants to the land in instances where the damage resulting from such activities is greater than the appreciation acquired by the land.

After eight years experience it seems that, although there is still the necessity for setting aside additional watershed areas for compulsory reforestation, the developments have greatly surpassed previous limits. These do not yet have legal status, but with the active collaboration of proprietors are spread by the help of publicity and example.

This development is due to the efficient organization of the work of the Soil Protection and Restoration Service, created in September 1941 and reorganized in 1945. This service actually is under the Department of Waters and Forests and is directed by mountain forests specialists. It includes a special group of district heads and lesser officials. At the end of 1947, it was composed of only 20 officials, but this number increased to more than 140 in 1948. It works in liaison with the Services of Bridges and Roads, Colonization and Engineering.

Until 1945 this work was rather experimental in character and, in all, affected 600 hectares over an extended area. In 1945, 460 hectares of land were placed under protective management, including 300 hectares planted to fruit trees and 76 reforested; in 1946, 1,097 hectares, of which 750 were planted to fruit trees and 236 reforested; in 1947, 2,130 hectares of which 1,500 hectares were planted to fruit trees and 300 reforested. For 1948 the plan was to place 5,000 hectares under this type of management. This Service has its own tree nurseries which are expected to distribute 300,000 fruit trees and 1,500,000 forest trees during the 1948/49 season. In three or four years, it is anticipated that their production will increase to one million fruit trees and three million forest trees annually.

CANADA

• A new policy has been started in British Columbia with the objective of maintaining the principles of free enterprise and at the same time assuring all forests of sustained yield. Actually only 7 percent of forest land in this province is privately owned, the rest is owned by the Government. The latter has, however, disposed of cutting rights on its own land in the form of licenses and leases. With some exceptions, no such leases or licenses have been granted since 1907 and 75 percent of the merchantable forest area contains unalienated government forests. Under the new legislation, the forest management license will guarantee a private individual or a corporation continuous use of a certain surface of land as long as the forestry operations are managed in a way to assure sustained yield. The forests operated under these licenses form a unit which, in forestry terminology, is called a "working circle" the exploitation of which assures the supply of industry in general or a specified group of industries. If such a license is requested by an individual who is already the owner of forests, the latter must be combined with Government forests for management purposes. A license will be granted only after consideration of all conflicting interests. It seems to be the intention of the Government to apply this system to 50 percent of its forest area in order to protect small industries which could not take on the load of managing large forest areas. The other 50 percent will be operated under Government sustained yield management. The legislation provides for the protection of public interests against all possible abuses of forests operated under licenses and also protects license owners against discriminatory decisions which could call for the cancellation of the license in the case where the clauses are not respected. The annual taxes for growing forests are reduced to a strict minimum (2½ cents per hectare); the main portion of forest taxation is deferred until the time of cutting and is then based on the value of the cutting (16 percent of the value). The license can be sold or transferred at the same time as the industry to which it attaches.

• Under the signature of the President of the Executive Committee of the Canadian Forestry Association, and under the title "Canada Needs a National Forest Policy," several Canadian forestry magazines have recently pointed out that there is a danger that the methods now generally used in forest management in that country will bring about a serious situation in the not too distant future.

In 1947, one-third of the country's export revenue was derived from forest products and, in 1946, the sale of wood, wood products, and paper to the United States brought in one-half of each U.S. dollar entering the country. The author is of the opinion that the provincial and the federal governments are under obligation to ensure the perennial renewal of their forests. Although some of the provinces have understood this obligation, so far others have devoted only an extremely small portion of the income derived from their forests to this purpose. Moreover, although the majority of private owners of forestlands and forest industries are concerned with the proper care of their forests, there are a few who are interested only in deriving the maximum immediate profits from the forest.

The author suggests the creation of a National Forestry Board, composed of provincial and federal government officials and the representatives of the forest industries. The principal problems to be solved include forest inventory-taking, fire fighting and combating insect pests and tree diseases. It is also necessary to promote a program of road construction and a research program for forest products. Finally, research on management and silviculture should be expedited, so that by the end of this century Canada will be in a position "to apply proper management methods to all accessible forests and double its annual cut."

Personalities

• Mr. Horacio Recart has recently joined the Forestry Branch of FAO's Division of Forestry and Forest Products from Santiago, Chile. Mr. Recart is a graduate of the College of Forestry of the University of Washington. In 1927 and 1928 he attended the Harvard Graduate School of Business Administration, and on returning to Chile was connected first with the Compania Maderera Malvoa (Malvoa Lumber Company) as Branch Manager in charge of Production at Temuco in southern Chile, and later was engaged in private activities in the lumber business. In 1936 he organized and taught a forestry course in the Escuela Industrial de Temuco, the first course of this nature ever established in the country. In 1942 he left the school at Temuco to join the Forest Industries Division of the Corporación de Fomento de la Producción (Chilean Development Corporation), an instrument of the Chilean Government to foster the industrial development of the country, and he remained with the Corporación until joining FAO. Mr. Recart was one of the organizers of the first national Forestry Congress in Santiago in 1943, and in 1946 also served as Professor of Silviculture at the College of Agriculture of the University of Chile.

Meetings

• The Canadian Society of Forest Engineers held its Fourteenth Annual Congress at Fredericton, New Brunswick, from 5 to 7 October 1948.

Amongst the resolutions adopted were references to fire prevention and protection; recommendations to pulp and paper industries to utilize sawmill waste; and the protection and administration of wild-life reserves, especially for beaver. Two are of special significance as indicating tendencies in forestry and the wood industries—the resolution that integrated utilization should be introduced into long-term forest management whenever possible and that research should be intensified on the silvicultural, economic and utilization factors involved; and that the Society strongly endorses the integrated utilization of farm woodlot products on a co-operative basis.

• The following meetings dealing with forestry or forest products are scheduled for 1949:

Latin-American Forestry and Forest Products Commission, Rio de Janeiro, May 23-28.

Third World Forestry Congress, Helsinki, July 10-20.

Forestry Education (informal meeting), Helsinki, July.

UN Scientific Conference on Conservation and Utilization of Resources, New York, August 17-September 6.

Wood Chemistry Committee, Brussels, August 25-27.

European Forestry and Forest Products Commission, Geneva, September 5-9.

Mechanical Wood Technology, Geneva, August 29-September 4.

ECE Timber Committee, Geneva, September.

Fifth Session of the FAO Conference, Havana, November 21.

Unexploited Forests Committee, Havana, November.

Reviews

Methods Used to Control Pollination of Pines in the Sierra Nevada of California. W. C. Cumming and F. I. Righter. Pp. 17. U. S. Department of Agriculture, Circular No. 792. September 1948.

This brief circular describes techniques originated at the Institute of Forest Genetics at Placerville, California, for the controlled pollination of pines under conditions prevailing in the Sierra Nevada. It furnishes detailed information regarding the equipment used and means of handling it for the isolation of the ovulate flowers, the harvesting of the male catkins, the extraction and conservation of pollen, the pollination process itself and, finally, for the protection of the cones against insects and squirrels until they have reached maturity. The methods and apparatus used, which have been improved during the past 20 years, have proven themselves practicable and effective. The description of this equipment and these methods is of practical value for all researchers engaged in forest genetics work. The bibliography at the end of the circular cites about thirty articles and pamphlets on the same subject.

Lumber Production in the United States 1799-1946. U. S. Department of Agriculture. Miscellaneous Publication No. 669. Washington, D. C., October 1948.

This volume collects in one place records of lumber production in the United States. The work summarizes statistics originally printed in about 50 publications, most of which are out of print.

The announced purpose of the publication is "to provide in condensed form for ready reference (1) all of the available records of lumber production, both as reported to the Bureau of the Census or to the Forest Service, (2) revised figures for total lumber production for certain years as estimated by the Forest Service, (3) the record of lumber prices for the years for which prices were obtained."

The report gives specific information with respect to the species from which lumber was produced and the state in which the lumber was manufactured. In other publications there is available still further information, with respect to specific years, as to the production within counties of the state.

The value of the book to readers is enhanced by the concise explanation of the means by which the figures were collected in the censuses and why it was found necessary to make corrections in the results obtained.

A Manual of the Timbers of the World. Alexander L. Howard. Pp. 751, 52s. 6d. Macmillan & Co., Ltd., London.

A revised Third Edition of this Manual was nearing completion when the author died in 1946. It has now been finished and published, forming a valuable work of reference. Besides an index to scientific names, the volume includes a useful index of vernacular names and a list classifying timbers according to their countries of origin.

Efficiency of Technique in Swedish Forestry. Distributed by Föreningen Skogsarbetens och Kungl. Domänstyrelsens Arbetsstudieavdelning, Regeringsgatan 46, Stockholm, Sweden.

This book has been published in English by the Scientific Management Institute, a research institute established by the large timber companies of northern Sweden and the Swedish Forest Service.

The book contains a series of summarized articles, previously published in booklets, leaflets or forestry journals by different Swedish experts. They deal with general applications attained by the research institute in its investigations for improving logging equipment and methods, and for discovering a fair and objective basis for determining wage agreements between forest employers and employees. The contents of this book of about 150 mimeographed pages is divided into five main sections covering the whole field of the institute's present activity. The first chapter deals with general problems, such as efficiency measures, time studies, and their use in forestry. The second chapter discusses the use and maintenance of logging tools, skidding and hauling equipment, and the construction and maintenance of main haulage roads. The major part of the book concerns the results obtained in investigations on the technique and organization of logging, studies of work output, analysis of working day in logging, the different problems arising in connection with the use of horses in forest transportation, and landings. The review is completed with a series of summarized articles on accident prevention and general safety in forestry work, and on the practical application of the results of the investigations upon the wage agreements in forestry and upon the publicity work of the institute.

Forests and National Prosperity: A reappraisal of the Forest Situation in the United States. United States Department of Agriculture Miscellaneous Publication No. 668. United States Government Printing Office.

The Forest Service in the U. S. Department of Agriculture has issued a report bringing together for the first time in concise form the over-all findings of the nation-wide forest reappraisal, field work for which it completed in 1946. The report outlines the principal federal measures which the Forest Service holds "necessary to assure ample timber supplies for the future" and "to build up and maintain the forest resources so as to insure their maximum contribution to lasting prosperity for our country."

After several sections devoted to forest land and timber resources, and how they are being managed, the report discusses the raw material supply and wood waste problems of the major forest industries. Watershed, range, recreational and wildlife uses and services are considered in relation to timber supply and forest management. Another section is devoted to forest protection from fire, insects and disease, and the report concludes with a discussion of how forest ownership affects the outlook for improvement in the nation's forest situation. Separate reports covering the various individual phases of the reappraisal, the most extensive study of the country's forests ever made, have been issued previously.

Warning that "if the United States is to maintain a place of economic leadership in the world of tomorrow, it can ill afford to temporize with its forests," the report declares not only that the sawtimber supply is declining under the impact of an anual cut which together with natural losses is 50 percent greater than current annual growth but also that its quality is deteriorating.

At the same time, the summary says, indications are that the nation's long-range potential timber requirement is considerably greater than the present annual cut, especially if prospective new uses for wood, export and a back-log for national security are taken into account. These needs include dependable timber supplies sufficient "to sustain and expand the supply of consumer goods and employment in the wood industry," to provide for national security, and "to contribute to international peace and well-being" through helping meet world timber needs in time of shortage.

Setting a long-range, flexible goal, the report suggests that if these needs are to be met the country should aim to grow from 18 to 20 billion cubic feet of all timber, including 65 to 72 billion board feet of sawtimber, a year. At present annual growth is put at 13 billion cubic feet of all timber, including 35 billion board feet of sawtimber. However, the report states that even if good forest protection, management, and practices were generally applied to American forests within the next few years it would still take several decades before this growth goal could be achieved.

Tomorrow's wood supply is in the forest trees growing today, but for the nation as a whole, according to the report, the forest growing stock is "below par in quantity, quality and distribution," while 164 million acres of the country's commercial forest area, or 35 percent, is "deforested or has less than 40 percent of full stocking." And the further the long-time depletion which produced this condition is allowed to go unchecked the more difficult and costly becomes the job of putting the forest resource in shape to meet the nation's need.

The report recognizes substantial progress in forestry, both public and private, in recent years. There is ample evidence, especially in the South and Pacific Northwest, where timber grows rapidly, that forestry pays and is good business. Throughout the country a growing number of owners are putting their lands under good forest management. The best showing is reported to be by the lumber and pulp companies which to-

gether own 15% of the commercial forest land in private ownership. Small holdings, which comprise three-fourths of the private forest land are said to be "the toughest problem." More vigorous action, concludes the report, is needed to get good forestry generally applied.

The action proposed requires the cooperation of federal, state, and local governments, private owners and interested agencies. It falls into three parts, (1) public aids to private forest landowners, especially small owners; (2) public control of cutting practices on private land sufficient to stop forest destruction and keep the land reasonably productive; and (3) expansion and intensified management of the national forests. The public aids, some requiring new federal legislation, others in effect but in need of strengthening, follow:

(a) More and broader technical assistance to private owners, particularly small owners, in establishing and tending forests, and in harvesting and marketing forest products, and corresponding assistance to mill operators and other processors. In this connection, the report says that in 1948 under a federal-state cooperative program 173 farm foresters gave such assistance to private owners in 650 counties in 40 states but that an adequate program in this field would cover some 2,000 counties.

(b) Stepping up of educational and demonstration work in forestry such as is done by federal and state agricultural extension services and private forestry agencies.

(c) Increasing federal aid to states in the production and distribution of nursery stock for forest planting, and making planting stock available to non-farm as well as farm owners. Emphasizing the need for more widespread forest planting, the report says there are 62 million acres of private forest land either denuded or so poorly stocked as to be practically idle; that prior to 1947 only about 2½ million acres of private land was successfully planted, and that in 1947 about 114,000 acres were planted.

Creation of a federally sponsored forest credit system to make long-term loans on terms and conditions suitable for forestry purposes, adapted to the needs of private forest operators, and contingent upon sound forest practices, together with a federally sponsored insurance system to protect such loans and to reduce the risk inherent in forestry enterprises.

Other measures proposed in this part of the program are additional federal aid to speed adequate forest fire protection for the 439 million acres of state-owned and private forest land in need of it; strengthening of cooperative protection against forest insects and diseases; expansion of all phases of forest research; encouragement of forest cooperative associations among small landowners; and service to states in the improvement of forest tax laws.

As to the second part of the action program recommended—"public control of cutting on private land sufficient to stop forest destruction and to keep the land reasonably productive"—the report recommends basic federal legislation setting up standards as a guide for local forest practices and authorizing federal financial aid to states which have regulatory laws consistent with its requirements. It would also provide for federal administration in states that request it or which, after a reasonable time, do not put regulation into effect. The law would not require sustained yield management nor, so long as cutting practices met required standards, would it regulate when or how much of his timber any owner might cut.

Dealing with National Forests, the program's third part recommends their further development and expansion "as a great public asset" capable of producing much larger returns in sustained output of timber, livestock forage, water, wildlife and recreation, if more intensively managed. As to expansion, it is recommended that there be added to the present National Forests and to state and community forests, a considerable acreage of land so badly depleted that it is unlikely private owners will restore them to productive condition, and certain areas of special importance for watershed protection and other public services.

Twenty-Eighth Annual Report of the Forestry Commissioners for the Year Ending September 30th, 1947. Pp. 68. His Majesty's Stationery Office, London, 1948.

This is a report on the post-war forestry program being carried out in England, Scotland and Wales. The program represents an intensive effort, commencing in 1947, on the part of the British Government to plant or replant an area of about 148,000 hectares (365,000 acres) by state action and by assistance to owners of private woodlands. The program provides also for the acquisition of land; for increased facilities for education, training and research on all branches of forestry; for up-to-date houses for forestry workers; for national forest parks; and for the miantenance and development of the large areas of young plantations already established by the Forestry Commission. It is gratifying to note from the report that much progress has been made. A total of 10,666 hectares (26,356 acres) were planted for the year ending September 1947 of which 10,082 hectares (24,914 acres) were conifers and 584 hectares (1,442 acres) broadleaved species. Much research work was carried out in silviculture, mensuration, forest pathology and forest entomology. A census of all woodlands, private and state, was taken. Three schools, in addition to those at Benmore and the Forest of Dean, were opened during the year, each to accommodate 60 students. Short courses for foresters and woodsmen were conducted at various private estates. A total area of 10,320 hectares (25,501 acres) were acquired during the year, of which 9,034 hectares (22,322 acres) were classified as plantable; and this brings the total area of land acquired for forestry purposes to 583,000 hectares (1,440,500 acres). All these operations were financed from a special government forestry fund. The figures for the year under report and the preceding year are as follows:

	1947	*1946*
Gross payments	£3,871,688	£1,937,614
Receipts	£ 660,690	£ 562,504
Net payments	£3,210,998	£1,375,110

The government subsidy to the forestry fund was £2,750,000 in 1946/47 and £4,856,000 in 1947/48.

Great Britain learned a bitter lesson in forestry during the last war. It is not surprising, therefore, that such a great effort is being made to practice forestry within her own boundaries to safeguard her future needs.

Industria Madeireira (Wood Industries). Portuguese. Imprensa Nacional, Rio de Janeiro, Brazil, 1949.

Technologia de Productos Florestais (The Technology of Forest Products). Paulo Ferreira de Souza. Pp. 409. In Portuguese. Imprensa Nacional, Rio de Janeiro, Brazil, 1947.

The author, a member of FAO's standing Advisory Committee for Forestry and Forest Products, has summarized the substance of lectures given during certain courses held under the auspices of the Brazilian Ministry of Agriculture. The volumes are based not only on personal experience covering a period of 30 years, but also on a wide knowledge of the methods used in research work carried out in Brazil and other countries. The work on wood industries deals with saws and saw mills, logging, transportation and storage. It covers wood seasoning and preservation, including the application of modern methods to the production of sleepers, poles, and to the fire proofing of wood. The author deals with lumber and lumber markets, and types of construction and industrial lumber native to Brazil. He discusses also the manufacture of laminated wood and plywood, the production of fiberboards, and the manufacture of briquettes, wood flour, rayon and plastics.

The work on technology gives an overall study of forest products in the world economy and in the national economy of Brazil. The author then studies in detail a number of wood uses which are important in South American countries, and finally reviews certain so-called minor forest products such as rosewood essence, quebracho, maté and rubber which are locally of great importance.

Forest Administration Plan, Nigeria 1946-55. Under a Ten-year Plan of Development for Nigeria, 1946. Price 9d. Government Printer, Lagos, 1948.

This plan results from recent studies and discussions based on experience and previous plans going back to 1905. Forest policy—the first essential—includes:

I

"(i) The main object of the forest policy of the Government of Nigeria is the production of the maximum benefit to the greatest number from the minimum amount of forest which is essential for the general well-being of the country.

"(ii) To achieve this object, two main principles should be observed: (a) The climatic and physical condition of the country must be preserved by the control, by maintenance or rehabilitation of vegetation, of the rainwater run-off in those areas where lack of control would cause damage to other lands or waterways and endanger the water supplies

and soil fertility. (b) The supply in perpetuity of all forms of forest produce to satisfy the wants of the people must be assured by the acquisition and preservation of an adequate forest estate.

"(iii) These two primary principles having been accepted, the following additional principles are natural corollaries: (a) agriculture must take priority over forestry; (b) the satisfaction of the needs of the people at the lowest possible rates must take precedence over revenue; (c) after (a) and (b) are satisfied the aim should be the production of the greatest revenue compatible with a sustained yield."

II

"Greatest stress will be laid upon the control, management and development of the savannah woodlands and high forest patches which contribute so largely to the supply of the every day needs of the people in the greater part of Nigeria."

III

"(i) Since planned management is impossible without security of tenure, first attention will therefore be given to the secure establishment of the Forest Estate, with a balanced distribution throughout Nigeria as far as natural and other circumstances permit.

"(ii) Reserves which have been put under planned management, with the approval of the Governor, shall be regarded as humanly speaking inviolable and not open to adjustment.

"(iii) The Forest Estate will be separated into two main divisions, the first of regional value consisting of the larger reserves, the second of strictly local value consisting of plantations and communal forestry areas."

IV

"(i) And any plan for the management of a reserve of more than 50 square miles shall require the approval of the Governor.

"(ii) The objects of management in any reserve shall be decided with due regard to the expressed interest of the forest owning community.

"(iii) The rotation of the crop and the methods of growing shall be decided under the advice of the Chief Conservator of Forests after consultation with other interests and taking into full consideration the maintenance of soil fertility."

V

"(i) Wherever the competence and will to undertake it exists, the control and management of forest reserve shall be devolved upon Native Administrations. Policy shall be to encourage the acceptance of responsibility by Native Administrations."

"(ii) Where the surplus products of a district are, or will be, required by Nigeria as a whole, and they can only be grown in a few limited localities, forest management shall provide for a sustained yield of such surplus produce for general use, but all revenue from sales shall accrue for the benefit of the local forest-owning community which has sacrificed land for its production."

VII

"It is most necessary that subsidiary industries using forest produce as raw material shall be developed and handed over to private enterprise, preferably African."

VIII

"(i) The use of natural or artificial forest growth as a fallow crop for agriculture and anti-erosion work will require the closest co-operation of the Agricultural and Forest Departments."

"(ii) Trained Forest Officers should be used only for such work as demands their technical and scientific knowledge and judgment, particularly for duties of an advisory or supervisory character.

"In the application of Forest Policy the very definite aim of the British Government must be kept clearly in view, eventually to establish a self-governing Nigeria. No attempt must be made to build up a highly efficient system of forest management which is effective *only* so long as it has European supervision, lest it prove unworkable when supervision is withdrawn. . . . The aim . . . must be to save for them their forests, to establish these as profitable working concerns, under plans which sacrifice the highest efficiency to simple continuity of treatment, and to train an African cadre which will manage them effectively. . . . It is the aim . . . to achieve . . . something which exists in concrete form, a working forest, trained staff or a simple recorded plan of operations, which can be handed over as a going concern to the African. . . ."

The first object of the plan is creation of a Forest Estate, including much land now fallow, common or waste, staffed by Africans, and adequate for an increased population with an improved standard of living. The plan sets up working units based on the Administrative Provinces, establishes provincial priorities, and specified staff organization for the various administrative levels. The rigid sequence of operations includes: 1. Reconnaissance and defining areas to be reserved. 2. Constitution of the primary forest estate, in general, which thereafter *must* be managed under plan for sustained yield. 3. Detailed consolidation of the forest estate—small changes in boundaries, etc. 4. Preparation of management plans, framed for application by an African staff. 5. At the same time, creation of a secondary forest estate to meet local demands not filled by the primary estate.

Provision is made for establishment of an African cadre. The field staff will continue with three grades, technical, uniformed and wardens. Training will continue and expand.

Increased utilization is required—more species, more areas and more efficient milling and recovery through several types of sawmills.

Changes in strength and character of staff required by the plan are set forth. Finally, safeguards are set up so that in its application the plan shall not be abandoned or distorted.

This is a thoughtful, workmanlike job of seeing the forest problem of a country as a whole, working out solutions suited to its own people and needs, emphasizing simplicity, setting up a long-range plan and program, taking due account of all factors. It disposes of any assumption that piecemeal, unco-ordinated development of forestry is the answer.

Our National Forests, Report of the Chief of the Forest Service, 1948, United States Department of Agriculture, Washington, D. C. 15 cents. U. S. Government Printing Office, Washington 25, D. C.

This report commemorates a milestone in public forestry in the United States of America and looks both backward and forward. Mr. Watts says: "Half a century has elapsed since administration of our national forests began. It seems appropriate at this time, therefore, to review some of the accomplishments in the development of our national-forest system and to outline major objectives for the years ahead.

"Our national-forest system is one of the largest, and in many ways it is the finest, public forest system in the world. It has developed steadily through the years, with encouraging support from the public, from Members of the Congress, and from the administration, regardless of what political party was in power. It has been and will continue to be the very foundation on which scientific forestry—forest conservation—in America is based. The national forests are performing useful and important services for the people of the United States; they are an important element in the national economy. With continuing support, they are capable of making even greater contributions to public welfare."

The establishment of forest reserves by the President was authorized in 1891, and some were set up. It was not until 1897 that Congress outlined a broad policy for their managed use—a policy with amendments which is still followed. Today, the system of national forests in 36 states and 2 territories contains 180 million acres of Government lands, This represents the largest tangible forestry accomplishment in the country; it is the keystone of American conservation and an increasingly important part of the whole national economy.

These forests are dedicated to the proposition that conservation is wise use and that their purpose is the "greatest good to the greatest number in the long run." Two basic principles govern their management: sustained yield of all their resources; and multiple use, under which coordinated use of all the resources on a given area is encouraged, rather than exclusive use of a single resource.

The many-sided values and problems of the national forests are analyzed—timber, forage, wildlife, recreation, and water. For each, the extent of use, significance in the national economy, opportu-

nities and needs for increased use, problems yet to be fully solved, are set forth. For the enterprise as a whole, the relation of costs and returns is to be viewed not alone on the basis of dollar income and of support to local governments, but by an appraisal of the very considerable monetary public developments furnished.

What, then, is needed to develop the system for maximum public service? Several things, says the report:

1. A stepped-up program of management and improvement for all the resources, expanding and intensifying practices of proven worth, moving from extensive to more intensive management, providing the operational facilities required.

2. Stability of public ownership, so that single uses such as mining, reclamation or hydroelectric power may no longer disrupt general resource programs until it is fully established that exclusive use is in the general public interest.

3. Consolidation and extension, so that the patchwork ownership pattern which grew up under the old public land laws may be rectified in the interests of effective unit management in the established national forests, and so that the authorized purchase program in areas not in the original national forest system may be pushed toward its established goals.

In a section on the national forests' place in the total resource picture, the report re-emphasizes the need for better practices on private lands, and for measures to attain that result.

In discussing the year's work on the national forests, the report records the appointment of a National Forest Board of Review, made up of private citizens, to advise on solution of problems arising in connection with use by the public. This is a new feature.

The work of the year includes many accomplishments of great interest and significance. The beginning of a pulp and paper industry in Alaska after 30 years' work; the generally successful combatting for the moment of organized livestock operators' efforts to prevent effective range management; continued progress on four upstream flood-control projects; expansion of recreational facilities; increased attention to critical wildlife problems; weathering one of the most severe fire seasons on record; expansion of roads to open unused timber areas; these are reported in detail.

The other major arms of Forest Service activity—cooperation in state and private forestry, forestry and forest products research and tropical forestry—have many significant developments to report in the work of the year.

This series of reports centers its attention from year to year on various major aspects of the diversified Forest Service job, and the problems and needs of American forestry. In emphasizing the national forests it brings to the fore the basic and inescapable conclusion that a strong, extensive, expanding, and aggressively and competently managed system of public forests is the indispensable leader in a national program of conservation.

Forest Farming and Rural Employment —A Study of Two Areas in Northern Wisconsin and Southwestern Arkansas. Charles H. Stoddard. Pp. 29. The Charles Lathrop Pack Forestry Foundation, Washington, D. C., 1949. For free distribution.

This publication is the report on a study started in 1945 of two areas in Northern Wisconsin and Southwestern Arkansas. It clarifies the opportunities and limitations of forest farming in the United States of America as a factor in postwar population and employment adjustments; it brings out the importance of co-ordination in tackling the problems of agriculture and rural employment in regions of "mixed economy" where forest land predominates; and it serves as a guide and stimulation to future studies which must be undertaken on the management of small forest holdings in the U. S. A. for more timber production for domestic use. The fact that 76 percent of all the forest land in the United States is held in private ownership, the fact that "the farmers' woodlot is in decadence and approaching extinction," and the fact that all efforts, national and sectional made so far to stimulate forest farming in the forest area and to solve the problems pertaining thereto have been rather "spotty," and applied with little or no co-ordination between them serve to enhance the importance of the question.

The author concludes that it seems unlikely that full-time forest farming will take a large place in the rural economy of either of the places studied. Part-time forestry farming in spite of all its limitations, such as indifference to good forestry, etc., appears more applicable to the needs of the resident population and the prevailing level of social and economic development. Part-time forestry employment will certainly supplement other farming activities in the rural communities. Recommending the measures for advancement of forestry by small owners, the author discusses for the Wisconsin study area fire protection, agricultural extension, agricultural conservation programs, county forest and the state forest crop tax law; and for the Arkansas study area, fire protection, farm woodland management project and the soil conservation district program. Concluding, the author recommends that some "service agency" be established on a co-operative or nonprofit basis, as envisaged in Report 6 (Forest Co-operatives in the United States, from A Reappraisal of the Forest Situation, U. S. Forest Service, 1947) and that the soil conservation districts, now set up under state law, would be the logical agencies or units to undertake the functions of such a service agency. The districts are usually set up on a county basis and are governed by local landowners who are members. "This study points to the conclusion that the acceptance of forest farming as an integral part in our agricultural tradition, whether on a part-time or full-time basis, can be hastened by developing institutional arrangements—such as soil conservation districts or co-operative organizations, as channels for complete forest management service to supplement and support programs of public assistance to individual forest landowners."

Geology of the San Gabriel Mountains, California, and Its Relation to Water Distribution. H. C. Storey, United States Department of Agriculture, Forest Service, in co-operation with California Department of Natural Resources, Division of Forestry.

By pointing out how geologic processes have produced rock formations with distinct effects on the distribution of local water supplies—both in time and in place—this new booklet illustrates one kind of information needed to plan for the efficient management of all mountain watersheds. Information on the modifying effects of soils, vegetation, and climate is also needed. Together, such knowledge will permit effective development of the State's water resources.

The booklet takes the view that "Basic to the maximum development of local water supplies, as well as to practices leading toward increased conservation of such water, is an understanding of the geology of the watersheds. Not only the types of rocks and their distribution, but also the past history of faulting, uplifting and erosion of the mountains, and the formation of alluvial fans, all have their places in determining the present occurrence of water. Events that date back some 50 million years have a direct bearing on water distribution today."

It discusses the geology of the area under such headings as Areal Geology, Structure and Geologic History. A great amount of work on these subjects has been done, and is cited in the bibiliography.

The report then analyzes hydrologic relations, discussing the effect of topography on rainfall, water stored in rock; the types of rock and summer streamflow; natural underground barriers, faults and dikes; underground basins; alluvial fan composition and water spreading; rock types and soil characteristics.

A concise summary includes the principal facts and conclusions and re-emphasizes that "the analysis presented in this discussion illustrates the type of information desirable in studying the water relations of a drainage basin. In making a study of an individual watershed, such as analysis, together with a detailed knowledge of the hydrologic characteristics of the soils, the modifying influences of vegetation and variations in precipitation, will provide a complete picture of water relations for the area. This information forms a sound basis for planning the most efficient management of mountain watersheds."

Corrigenda

Vol. II, no. 4, Page 195, last paragraph—"output in 1947 of 1.1 million metric tons being 25 percent greater than 1946 production and about double the prewar figure" should read "output in 1947 of 1.1 million metric tons being 25 percent greater than 1946 production and about ten times the prewar figure."

Vol. II, No. 6, Page 293, Col. 1, par. 6, last sentence, after teak forests add "or dipterocarp forests."

Vol. II, No. 6, Page 342, third col. under New Zealand, add "government" before woodpulp mill.

THE Nations accepting this Constitution, being determined to promote the common welfare by furthering separate and collective action on their part for the purposes of

raising levels of nutrition and standards of living of the peoples under their respective jurisdictions,

securing improvements in the efficiency of the production and distribution of all food and agricultural products,

bettering the condition of rural populations,

and thus contributing toward an expanding world economy,

hereby establish the Food and Agriculture Organization of the United Nations . . . through which the Members will report to one another on the measures taken and the progress achieved in the fields of action set forth above.

—Preamble to the Constitution of the Food and Agriculture Organization of the United Nations

FAO Member Nations

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Austria
Belgium
Bolivia
Brazil
Burma
Canada
Ceylon
Chile
China
Colombia
Costa Rica
Cuba
Czechoslovakia
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Ecuador
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Ethiopia
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Haiti
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